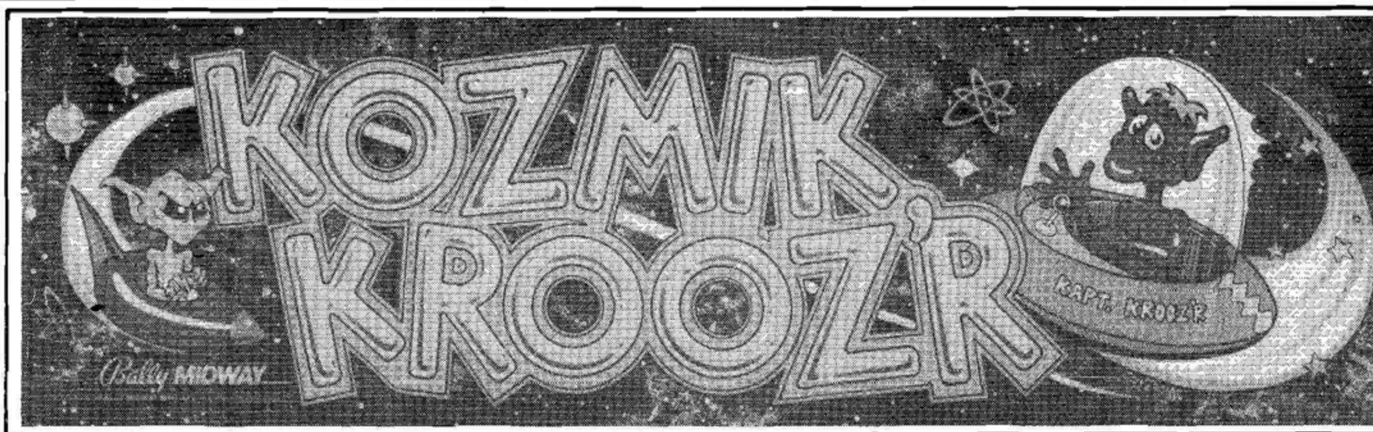
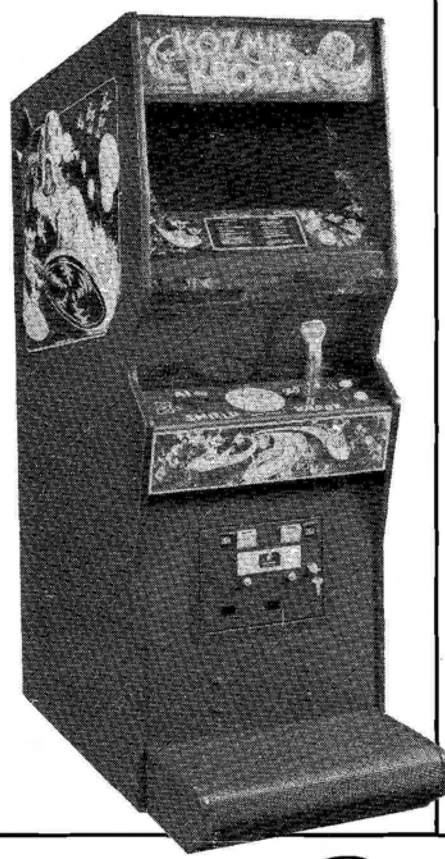
March 1983
Game No. 639



Parts and Operating Manual



Bally

MIDWAY MFG. CO.

10750 W. Grand Avenue
Franklin Park, Illinois 60131
U.S.A.

Phone: (312) 451-1360 Cable Address: MIDCO Telex No.: 72-1596

Form No. 0639-00300-0000

WARNING
THIS GAME MUST BE GROUNDED. FAILURE TO DO SO MAY RESULT IN DESTRUCTION TO ELECTRONIC COMPONENTS.

WARNING: This equipment generates. uses. and can radiate radio frequency energy and if not and used in accordance with the instructions manual. may cause interference to radio communications. It has been tested and found to comply with the limits for a CLASS A computing device pursuant to SUBPART J of PART 15 of FCC RULES. which are designed to provide reasonable protection against such interference when operated in a commerical environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

ELECTRICAL BULLETIN: FOR ALL APPARATUS COVERED BY THE CANADIAN STANDARDS ASSOCIATION (CSA) STANDARD C22.2 NO. 1, WHICH EMPLOYS A SUPPLY CORD TERMINATED WITH A POLARIZED 2-PRONG ATTACHMENT PLUG.

CAUTION: TO PREVENT ELECTRIC SHOCK DO NOT USE THIS (POLARIZED) PLUG WITH AN EXTENSION CORD, RECEPTACLE OR OTHER OUTLET UNLESS THE BLADES CAN BE FULLY INSERTED TO PREVENT BLADE EXPOSURE.

ATTENTION: POUR PREVENIR CHOCS ELECTRIQUES NE PAS UTILISER CETTE FICHE POLARISEE AVEC UN PROLONGATEUR. UNE PRISE DE COURANT OU UNE AUTRE SORTIE DE COURANT, SAUF SI LES LAMES PEUVENT ETRE INSEREES A FOND SANS EN LAISSER AUCUNE PARTIE A DECOUVERT.

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Kozmik Krooz'r

IMPORTANT NOTE

DO NOT plug in your new game yet. Before you do anything to your game, we recommend that you read SECTIONS I and II of this manual completely. It will not take more than a few minutes and it may be very helpful.

Introduction

Your NEW GAME is for one or two players. There is ONLY one model: the "UPRIGHT". When the two player mode is selected on the Upright model, the players take turns at the controls to guide their player through the game course.

When playing this game, you are the controlling force. It is up to you to direct your player successfully through the game course. Your job is to give guidance and provide offensive and defensive strategy to enable your player to overcome all obstacles.

Your opponents will use every trick in the book, and may even invent a few new ones, to overcome your various strategies and eliminate your player(s). You really have to keep a close eye on them at all times.

As your skill level increases, you will notice that your opponent's offensive abilities greatly increase. Any advantages you once had at the beginning of the game will gradually be reduced until they are completely gone.

Bonus players may or may not be awarded depending on the options the game owner has selected. The point values of all items are listed below.

Major Features

Your game has been provided with a new improved Power Chassis designed to help reduce electrical interference with other equipment.

It is also equipped with a detailed self-diagnostic package. This includes the following abilities: 1) The game has OWNER/OPERATOR selected variable levels of difficulty so game play can be tailored to player skill level in his area; 2) There is a new and easy to use diagnostic package featuring: a complete ROM/RAM check with bad chip location information read out on the monitor screen; the capability to check each of the game's different sounds **INDIVIDUALLY;** provision for checking each control and switch **SEPARATELY;** a full function Bookkeeping mode; an entire options list that can be set from the front console with **NO NEED** to crawl inside the back of the cabinet and look for tiny switches located on P.C. boards; a sound system test; and a "PRE-SET" category that can return **ALL** information in the Bookkeeping mode to zero and/or all operator selected options back to factory recommended settings; and 3) The game is equipped with a rechargeable battery so that it won't forget where it was the night before at closing — even if you turn it off. It will "remember" this information for up to two weeks.

Game Objective

The object of the game is to **HAVE FUN** and survive as long as possible while constantly improving your skills and advancing to the highest rack that you can. As you do this, each following rack of the game will have more and greater obstacles for you to overcome, and will in general be harder to complete.

DESCRIPTION	POINTS AWARDED	NOTES
RAM SHIP	100	
SHOOTER SHIP	200	
STRIKE SHIP	200	
SCOUT SHIP	300	
SPEED DEMON	2500	APPEARS IN ALL RACKS
SPACE MINE	100	
FORMATION FIGHTER	100	
MINE LAYER	200	
SPY SHIP	300	

Assigned Point Values

I. Location and Setup

INSPECTION:

1. Remove the game from its shipping crate.
2. Inspect the entire outside of it for any signs of damage.
   - ☐ Any scratches?, dents?, cracks?
   - ☐ Any broken controls?
   - ☐ Any broken glass or plastic?
   - ☐ Just look it over closely and make a note of any signs of damage.
3. Remove the shipping cleats from the bottom of the cabinet.
   - ☐ **UPRIGHT MODELS ONLY:** In order to help prevent easy theft of your game, you may wish to remove the Caster Wheel Assemblies from the bottom of your cabinet at this time.
4. Install the four levelers, one at each corner of the cabinet.
   - ☐ Level the cabinet.
5. After you have installed the game's Leg Levelers, if desired, you may now install the game's FOOTSTOOL. See Figure 1-1. This is accomplished by:

☐ **MAKING SURE NO POWER IS GOING TO THE GAME.**

☐ Removing the FOOTSTOOL mounting hardware from its bag.

☐ Install the FOOTSTOOL'S Leg Levelers and set them to approximately the same height as those you just installed to each of the game cabinet's corners.

☐ Open the coin box door.

☐ Install the FOOTSTOOL mounting bolts and washers as shown below.

NOTE: The FOOTSTOOL is equipped with one factory installed "T" nut for **EACH** mounting bolt.

☐ Start all four FOOTSTOOL mounting bolts into their respective "T" nuts **BEFORE** tightening.

☐ Tighten the four FOOTSTOOL mounting bolts **EVENLY!**

☐ Close the coin door and make any final adjustments necessary to the FOOTSTOOL'S Leg Levelers so that they will solidly support the weight of anyone who stands on the FOOTSTOOL.

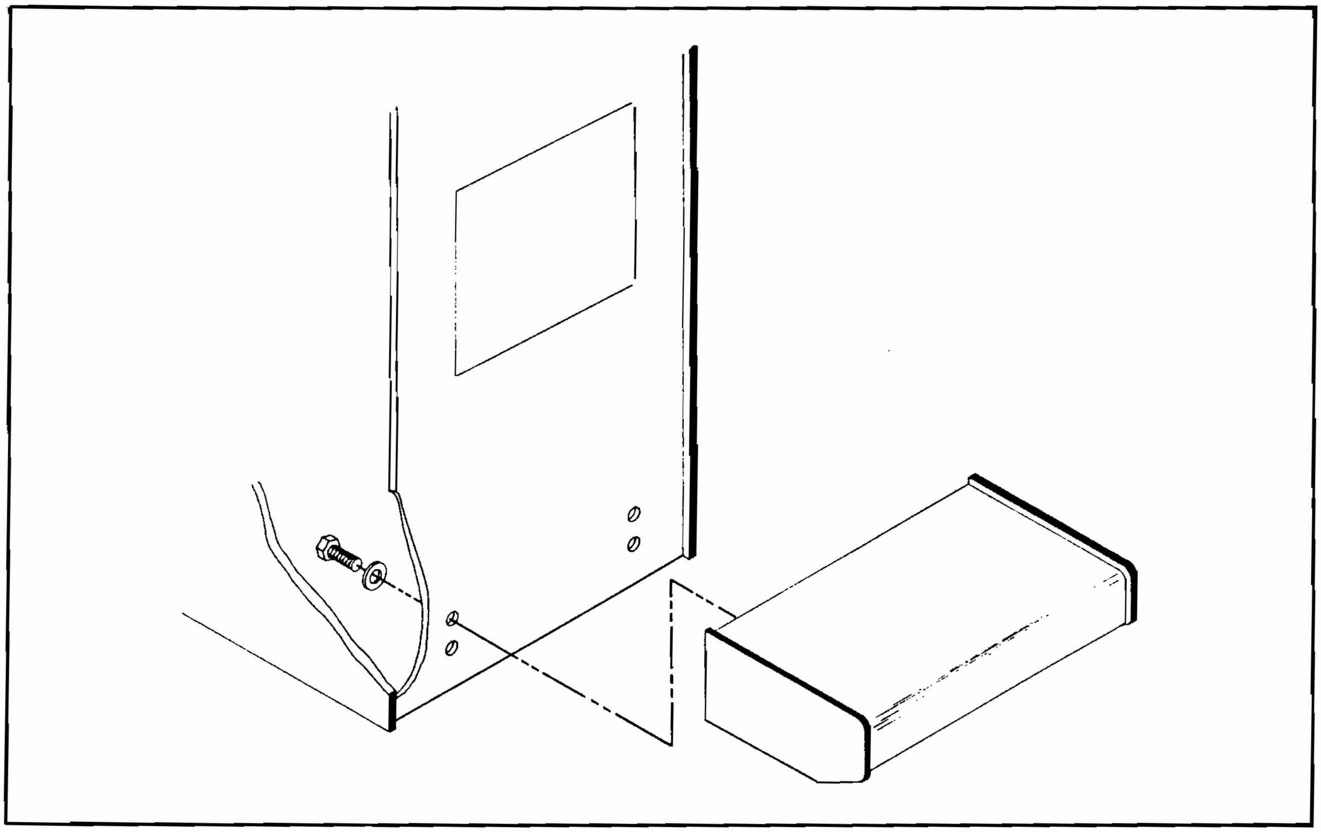


Figure 1-1 Installing the Footstool

6. Open the cabinet and inspect the inside of the game for any signs of damage. See Figure 1-2.
   - ☐ Also check to make sure all plug-in connectors on the wire harness are firmly seated.

     NOTE: ALL connectors or plugs are keyed so they will only go together when all pins are properly lined up.
   - ☐ Replug any connectors found unplugged. DO NOT FORCE PLUGS ONTO CONNECTORS. DO NOT FORCE PLUGS TOGETHER. If it won't go on easily, assuming the keys are lined up, it either does not belong there or is damaged.
   - ☐ Make sure all printed circuit boards (P.C.B.'s) are firmly seated in their connectors. See Figure 1-2. These connectors are also keyed. The P.C.B.'s will only go into them one way without being damaged.
   - ☐ Note the location of the game's serial number. See Figure 1-2.
   - ☐ Check all major subassemblies to be sure they are mounted securely. These are called out in Figure 1-2.

     Power supply.
     Control panel.
     T.V. monitor.
     Other P.C.B.'s and/or P.C.B. rack, etc.
     Power Chassis Assembly.
7. Make a note of any problems that can't be easily corrected.
8. Call your distributor and/or service man about your problem list.

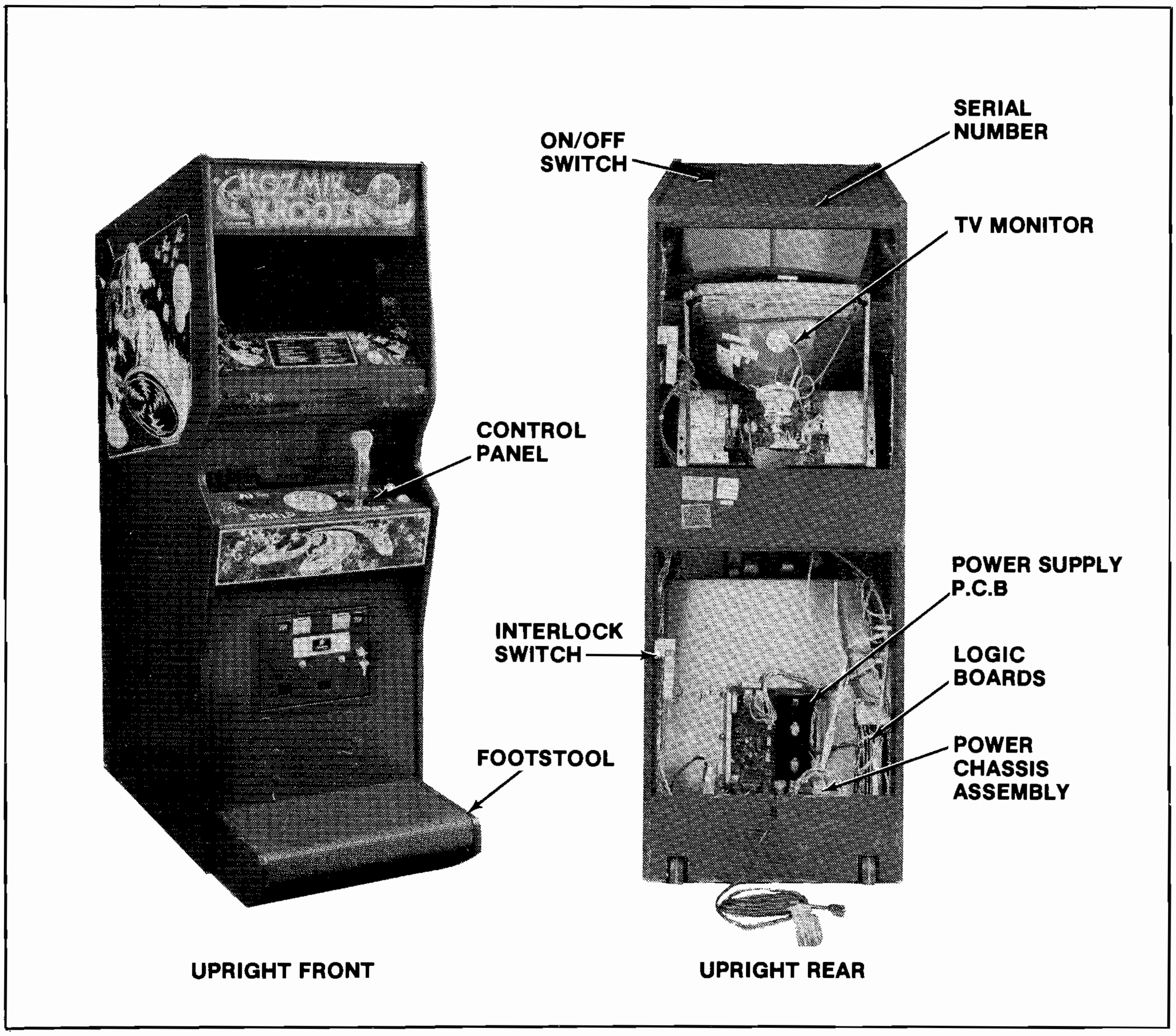


Figure 1-2 Location of Serial No., Interlock Switch, & Major Sub-Assemblies

INSTALLATION

1. Location requirements:

- ☐ **Power:**
  Domestic 110 V @ 60 Hz
  Foreign 200 V to 240 V @ 50 Hz
- ☐ **Temperature:** 32° to 100° F (0° to 38° C)
- ☐ **Humidity:** Not over 95% relative
- ☐ **Space required:**
  Upright 25"x40" (63x102cm)
- ☐ **Game height:**
  Upright 72" (183cm)

2. Voltage Selection:

Your game is designed to work properly on the line voltage where you are located. Check your line voltage with a meter to determine what its value is. Then check the power input wires to the main power supply transformer on your game to be sure they are connected to taps which correspond to your line voltage value.

If the power input wires to the main power supply transformer are not connected to taps which correspond to your local line voltage, move them to the proper taps.

If the line voltage in your area falls outside the upper or lower limits of the range of inputs covered by the main power supply transformer, **DO NOT PLUG YOUR GAME IN** until you have talked with your distributor and/or service man and obtained a solution to this problem. Otherwise you could damage your game.

3. Interlock and power ON/OFF switches. See Figure 1-2.

- ☐ To help prevent the possibility of getting an electric shock while working inside the game cabinet, interlock switches have been installed at each cabinet access door (this **DOES NOT** include the coin door in the Upright models).
- ☐ When any access door is opened, the interlock switch installed there turns off all power to the game.
- ☐ Check each interlock switch for proper operation.

  After checking the line voltage in your area and determining that the input wires to the main power supply transformer of your game are connected properly — or — after obtaining a solution to your over or under voltage problem from your distributor and/or your service man, plug the game into your A.C. wall outlet.

  The game ON/OFF switches for all models are located as shown in Figure 1-2. Turn the game on and allow it to warm up a few minutes.

  Slowly open each access door to the game (this does not include the coin door on the Upright models).

  As the door is opened approximately 1" (2.54cm) the power to the game should go off (the T.V. monitor, all the lights, and all sounds will stop).

  If this does not happen, check the interlock switch by this door to see if it has broken loose from its mounting or if it is stuck in the "ON" position.

  If the switch is found to be bad, turn the game off, unplug it, and replace the interlock switch.

  When done, plug the game back into the wall outlet, close the access door, and turn the game back on.

  After the game has warmed up, repeat the above interlock switch test.

  When the interlock switch is working properly and turns the power to the game off, power may be restored to the game with the access door(s) open. Take hold of the interlock switch plunger and **gently** pull it out to its fully extended position. THIS IS TO BE USED **ONLY** FOR SERVICING THE GAME. See Figure 1-3.

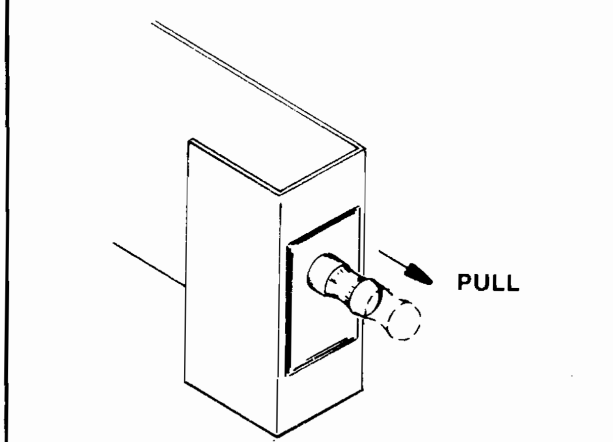


Figure 1-3 Interlock Switch Operation

SELF-TEST

Your new game will Self-Test itself to see if it has any bad parts. The information it receives while testing itself will be shown on the T.V. monitor. Some information can also be heard through the game's speaker system. See the SELF-TEST section for a more detailed description of this function.

When there is a bad result according to the Self-Test, call your distributor and/or service man to have the trouble fixed unless it is something you can do yourself (such as replace a bad RAM or ROM chip).

GAME VOLUME ADJUSTMENT CONTROL

See Figure 1-4.

The game volume control pot is just inside the cabinet, not far from the coin door frame. There is only one pot. For adjustment, it may be reached through the coin door.

To make the sounds louder, turn the pot clockwise as you face it (↷).

To make the sounds **less** loud, turn the pot counter-clockwise as you face it (↶).

OPTION SWITCH SETTINGS

To change the most common option switch settings, you **DO NOT** have to take the game apart or go into the cabinet and hunt for tiny switches on P.C. boards. These most common options can be changed from the main console of the game while it is in the Self-Test mode. The Self-Test switch is located just inside the cabinet not far from the coin door frame as you face it.

When changing any options, ALWAYS perform the Self-Test and play the game to be sure the ones selected are working properly. Of course, when you must change one of the switches that is located on one of the game's P.C. boards, it is also recommended that you perform the Self-Test and play the game to be sure the switches have worked properly and that no switches were accidentally moved that were not meant to be. (These switches are small and this can happen.)

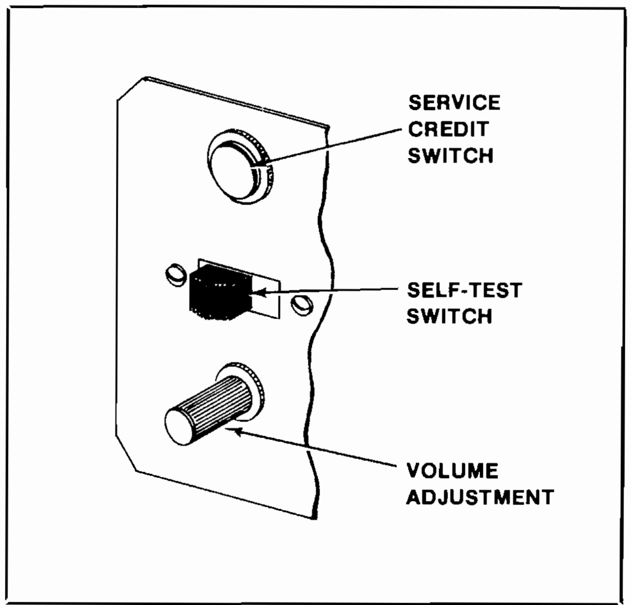


Figure 1-4 Game Volume Adjustment Control

The P.C. Board option switch settings, and what they will make the game do are shown in Figure 1-6. These switches are **MAINLY INTENDED** for use by a technician who is checking and/or performing tests on the game. See Figure 1-5 for option switch locations.

NOTE: In order to set the option switches located on the game's P.C. Boards, these Boards need not be removed from their card rack.

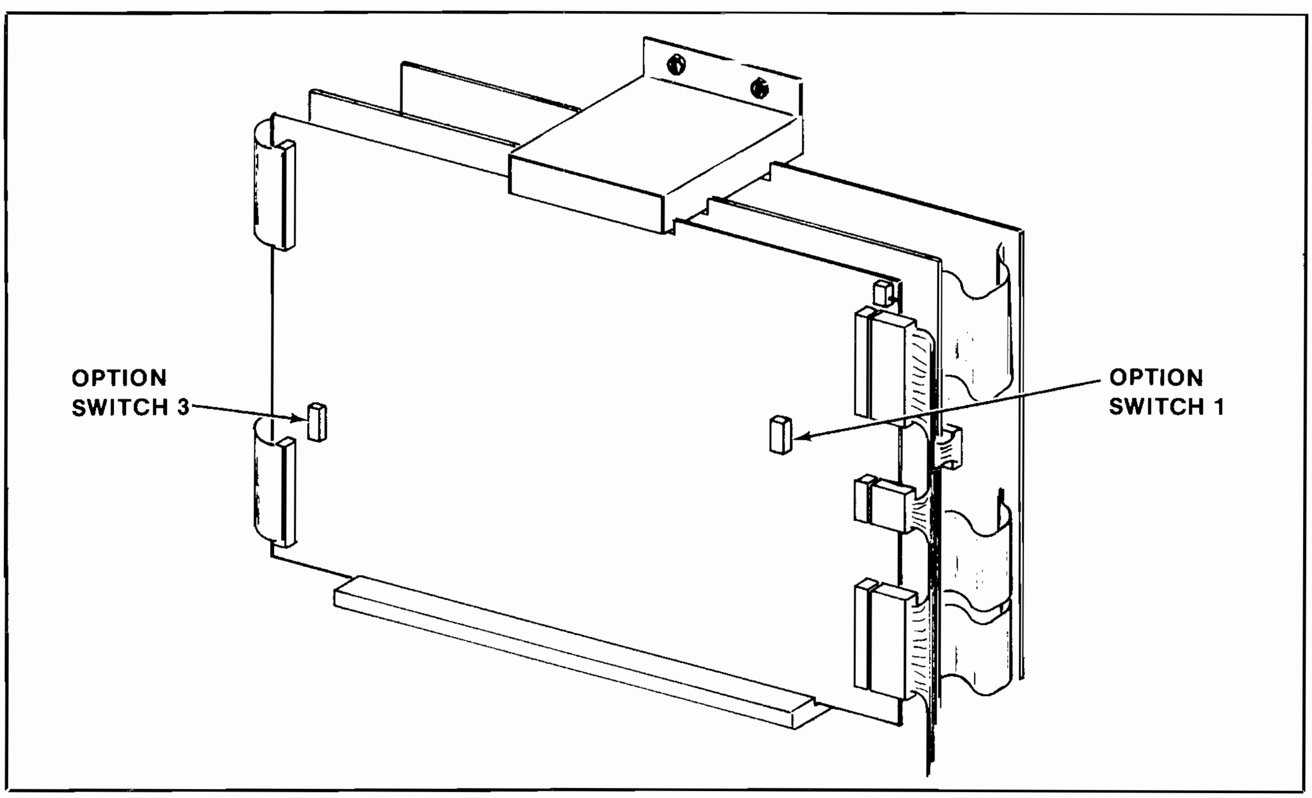


Figure 1-5 Option Switch Locations

KOZMIK KROOZ'R

OPTION SWITCH SETTINGS

SWITCH NO. 1 — AT B3 — LOCATED ON SOUND I/O P.C. BOARD

	SW#1	SW#2	SW#3	SW#4	SW#5	SW#6	SW#7	SW#8	SW#9	SW#10
DURING GAME PLAY:	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED		NOT USED	NOT USED	
COCKTAIL TABLE							**ON**			
UPRIGHT							**OFF**			
FREEZE VIDEO										**ON**
**NORMAL OPERATION										**OFF**

SWITCH NO. 3 — AT D14 — LOCATED ON SOUND I/O P.C. BOARD

	SW#1	SW#2	SW#3	SW#4
**NORMAL OPERATION	**OFF**			
SOUND I/O DIAGNOSTIC MODE	**ON**			
**NORMAL OPERATION		**OFF**		
RAM/ROM TEST INDICATES TEST RESULTS VIA YELLOW LED ON SOUND I/O BOARD: **FAST FLASH** = **BAD ROM** **SLOW FLASH** = **BAD RAM**		**ON**		
**NORMAL OPERATION			**OFF**	
OSCILLATOR TEST			**ON**	
**NORMAL OPERATION				**OFF**
FILTER TEST				**ON**

* NO EFFECT IF SW#1 OF SWITCH NO. 3 IS IN THE "OFF" POSITION.
** INDICATES FACTORY RECOMMENDED SETTINGS.

PART NO. **M051-00639-A014**

THE REMAINDER OF YOUR NEW GAME'S MOST COMMON OPTION SETTINGS ARE CONDUCTED DURING THE **MACHINE SETUP** PORTION OF THE SELF-TEST MODE AND WILL BE COVERED IN DETAIL IN THAT SECTION OF YOUR MANUAL.

Figure 1-6 Option Switch Settings

II. Game Operation

SELF TEST MODE

The Self-Test mode is a special mode for checking game play statistics as well as game switches and computer functions. It is the easiest and best way to check for proper operation of the entire game.

NOTE: Putting the game into Self-Test **WILL NOT** cause the game to erase any CREDITS it has in its memory when the Self-Test mode is entered.

You may begin a Self-Test at any time by sliding the Self-Test switch to the "ON" position after the power to the game is on (the Self-Test switch is located just inside the cabinet coin door frame as you face it). When this is done, the game will react as follows:

1. If the game is in the Attract mode when the Self-Test switch is moved to the "ON" position, it will finish the sequence and then go into the Self-Test mode. This is illustrated by the display of the Self-Test Mode Menue on the monitor screen.
2. If the game is in the Ready-To-Play mode or the Play mode when the Self-Test switch is slid to the "ON" position, it **WILL NOT** go into the Self-Test mode until **AFTER** the game is over. At this point, the game will go into the Self-Test mode. Again, this is illustrated by the display of the Self-Test Mode Menue on the monitor screen.
3. The fastest way to enter the Self-Test mode is to slide the Self-Test switch to the "ON" position and then activate the "TILT" switch located on the back side of the coin door just below the lock mechanism. The game will then **IMMEDIATELY** go into the Self-Test mode.

The Self-Test mode has eight (8) major categories as illustrated by Figure 2-1.

1. It is easy to select what category you want to enter. By following the ON SCREEN instructions, the Cursor at the left of the screen can be moved UP or DOWN until it is in front of the category you want to test.
2. After the Cursor has been positioned, follow the ON SCREEN instructions again, and the monitor screen will display the test category you have selected.

> **NOTE:** There is one exception to this. If you select the "PRE-SET" category on the Self-Test Mode Menue, EVERYTHING, I repeat — **EVERYTHING** — including **ALL** information in the "BOOKKEEPING" mode, and **ALL operator selected options,** will be set back to zero ("0") and to the factory recommended settings — **respectively.**

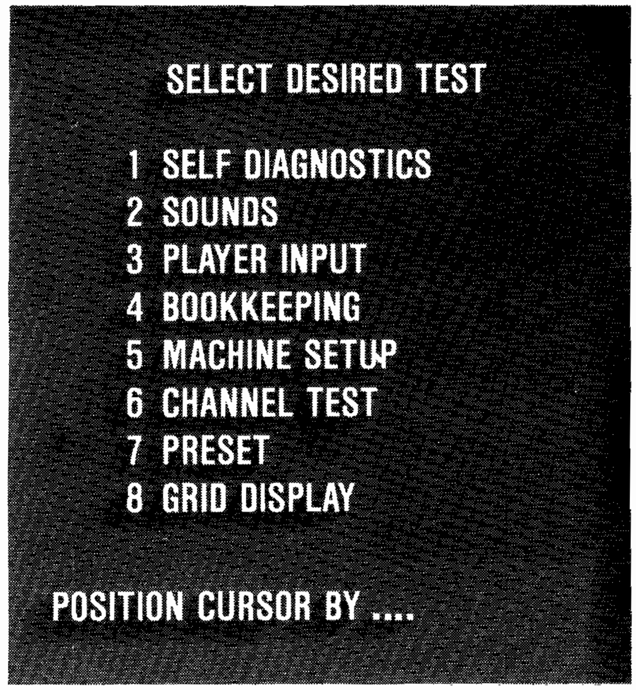


Figure 2-1 Self-Test — Menue

- ☐ Once you are **IN** one of the Self-Test mode categories, FOLLOW THE **ON-SCREEN** INSTRUCTIONS TO **COMPLETE** THE TEST.

3. The next group of Figures show the **CORRECT** screen presentation for **EACH** category of the Self-Test mode.

During the SELF DIAGNOSTICS section of the Self-Test mode, you will **first** see a cross hatch pattern on the screen for about 1/2 second. **Second,** you will see a lot of different colored bars shown on the monitor screen. These bars will be UNpainted one at a time from the top down. **Third,** you will see the screen painted Red, Blue, and Green in bars from the top down. **Fourth,** all the different colored bars you saw **"Second"** are displayed again. And **fifth,** the different colored bars are replaced by an exit message. If you do not exit, the test will repeat itself. This feature was designed into the game to enable over-night testing for an intermittent hardware problem.

If the SELF DIAGNOSTICS find one or more bad ROM or RAM chips: instead of going through what is described above, the game will give you a written message as to which parts are bad. This message includes their I.D.'s and their P.C. Board locations.

During the SOUNDS section of the Self-Test mode, the game will give a display which looks like that shown in Figure 2-1a.

- ☐ In this category, each of the game's separate sounds can be checked individually in any order— or — you can tell the game to check them all in order.

During the PLAYER INPUT section of the Self-Test mode, the game will give a display which looks like that shown in Figure 2-1b.

- ☐ In this category, each of the game's player operated controls — including the coin switches on the back side of the coin door — may be checked individually. A game sound will be heard as each switch/control is actuated. If no game sound is heard, that switch/control is either not working, miswired, or disconnected. Check it out thoroughly.

During the BOOKKEEPING section of the Self-Test mode, the game will give a display which looks like that shown in Figure 2-1c.

- ☐ In this category a basic bookkeeping function is performed. And with the selection of the "TIME REPORT" and the "SCORE REPORT", detailed breakdowns of game times and scores may be obtained.

In the TIME REPORT and SCORE REPORT sections of the BOOKKEEPING mode, the game will give displays which look like those shown in Figures 2-1d and 2-1e respectively.

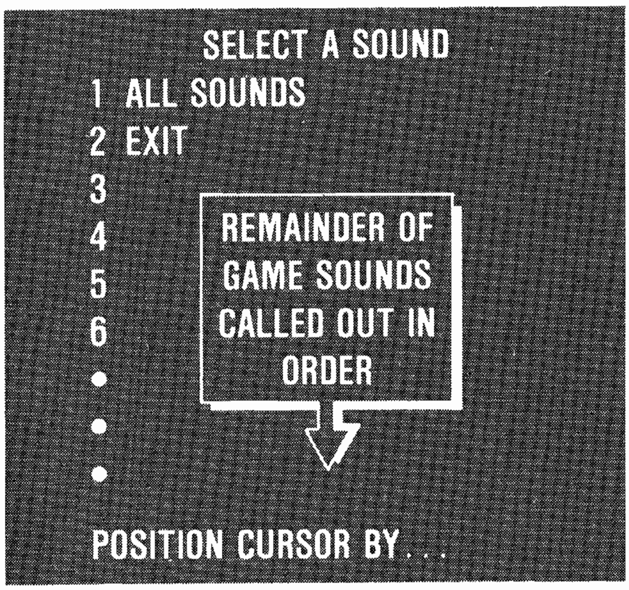


Figure 2-1a Self-Test — Sounds

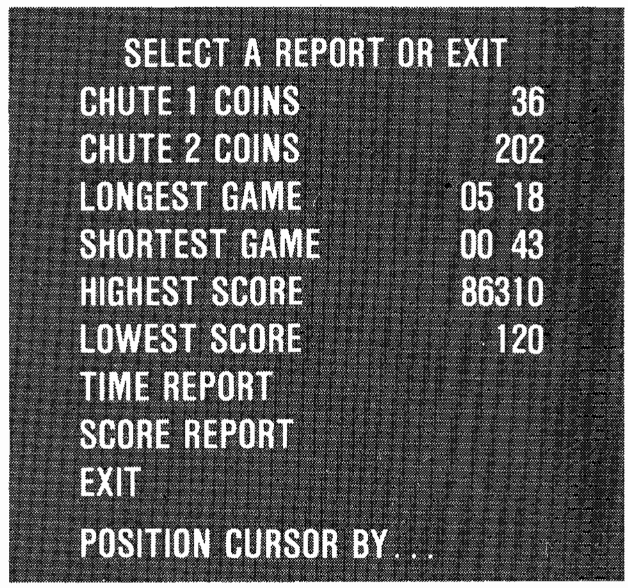


Figure 2-1c Self-Test — Bookkeeping

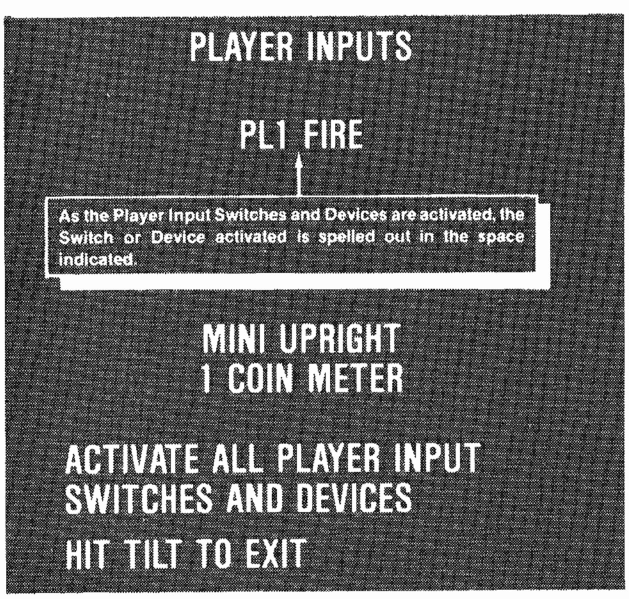


Figure 2-1b Self-Test — Player Inputs

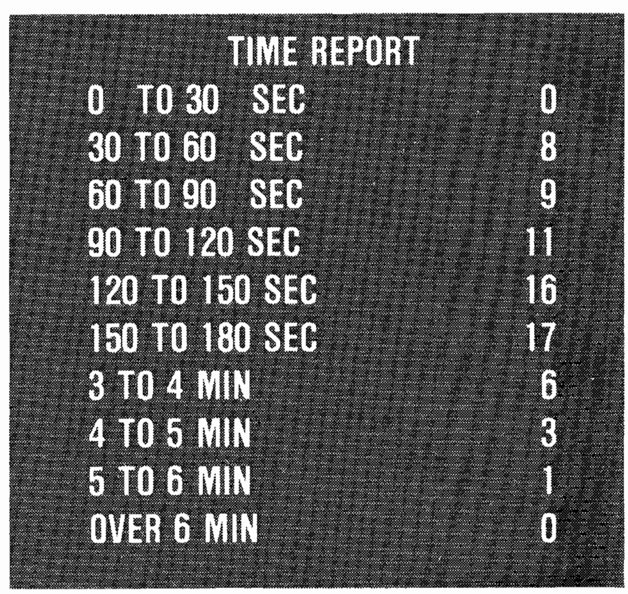


Figure 2-1d Self-Test — Time Report

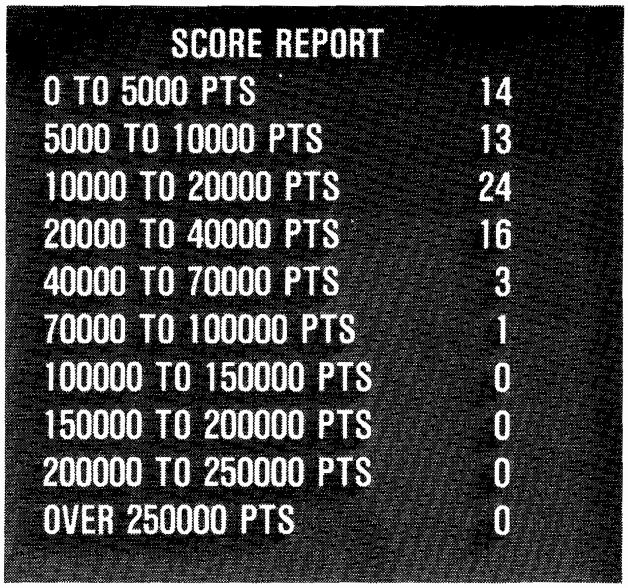
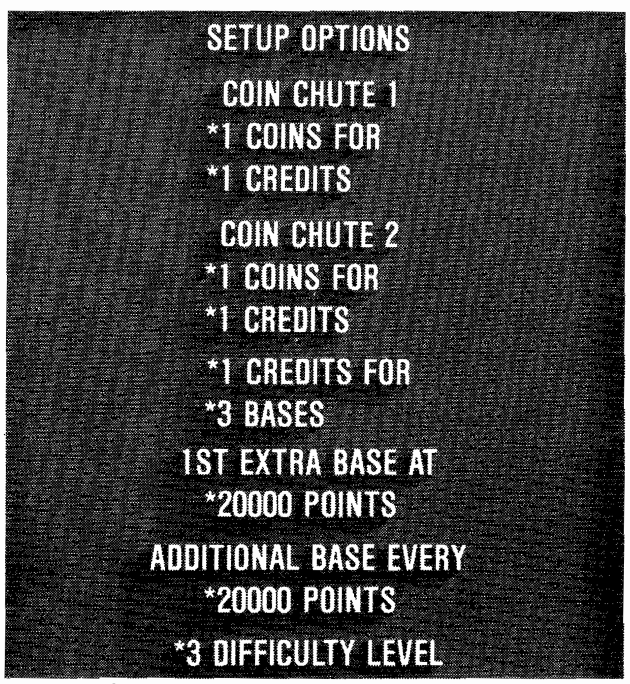


Figure 2-1e Self-Test — Score Report

During the SETUP OPTIONS section of the Self-Test mode, the game will give a display which looks similar to that shown in Figure 2-1f.

- ☐ In this category, all common game options may be changed from the control console: coins per credit, credits per base, bonus base(s) awarded at, difficulty level - -, and so on.



*** = Factory recommended settings.**

Figure 2-1f Self-Test — Set-Up Options

DIFFICULTY LEVEL EXPLANATION:

The Difficulty Level setting has a range of 1 to 9. With 1 being the easiest level of play and 9 being the most difficult level of play. We recommend that a setting of 3 be used as a beginning point.

Game play can then be made **MORE** difficult or **LESS** difficult, according to the skill levels attained by the players in your area.

CHANNEL TEST:

During the CHANNEL TEST section of the Self-Test mode, the game will give a display which looks like that shown in Figure 2-1g.

- ☐ In this category, the game conducts a test of its SOUND SYSTEM.

Once you enter the CHANNEL TEST section of the Self-Test mode, the game automatically tests Channels 1 through 6 giving a tone for each one as it checks it. After the 6th Channel is tested, the game automatically repeats the test until exited. It then goes back to the Self-Test Mode Menue.

During the GRID DISPLAY section of the Self-Test mode, the game shows a white cross hatch pattern on the monitor screen. This is for alignment and/or test purposes. This pattern will remain on the monitor screen until exited. The game will then go back to the Self-Test Mode Menue.

To leave the Self-Test mode, simply slide the Self-Test switch to the "OFF" position at **ANY** time. The game will then run through the ROM/RAM test display after which normal game functions will return to the monitor screen.

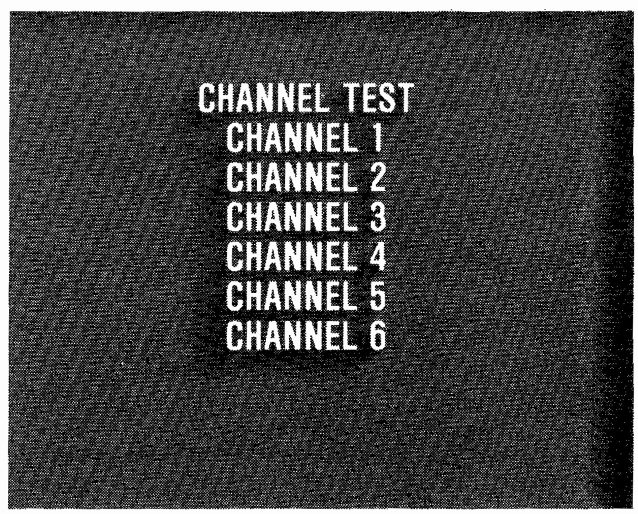


Figure 2-1g Self-Test — Channel Test

RACK ADVANCE:

The game can be made to advance through the various racks by beginning a game **and THEN** sliding the Self-Test switch to the "ON" position. After this has been done, each time you depress the ONE PLAYER BUTTON the game will advance one rack.

When you reach the desired rack, slide the Self-Test switch to the "OFF" position. (If you leave the Self-Test switch in the "ON" position, the game will go into the Self-Test mode when you are finished playing.)

CROSS HATCH PATTERN:

A cross hatch pattern is shown on the screen when power is first turned on to the game, when the TILT Switch is actuated, and during the "SELF DIAGNOSTIC" portion of the Self-Test mode, and during the "GRID DISPLAY" portion of the Self-Test mode.

This pattern may be kept on the screen for adjustment purposes as described earlier.

When you are finished using the cross hatch pattern, simply exit at the GRID DISPLAY to return to the Self-Test Mode Menue.

HARDWARE MASTER RESET SWITCH:

There are two of these little red switches, one on the Sound I/O Board and one on the CPU Board, located as shown in Figure 2-2.

The function of each of these switches — when pressed — is to make the game think it has **JUST** been turned on. They set up an "initial power-up" condition.

We **DO NOT** recommend that you indiscriminately press **EITHER** of these switches. They should **ONLY** be used if there is a major problem encountered while testing the P.C. Boards.

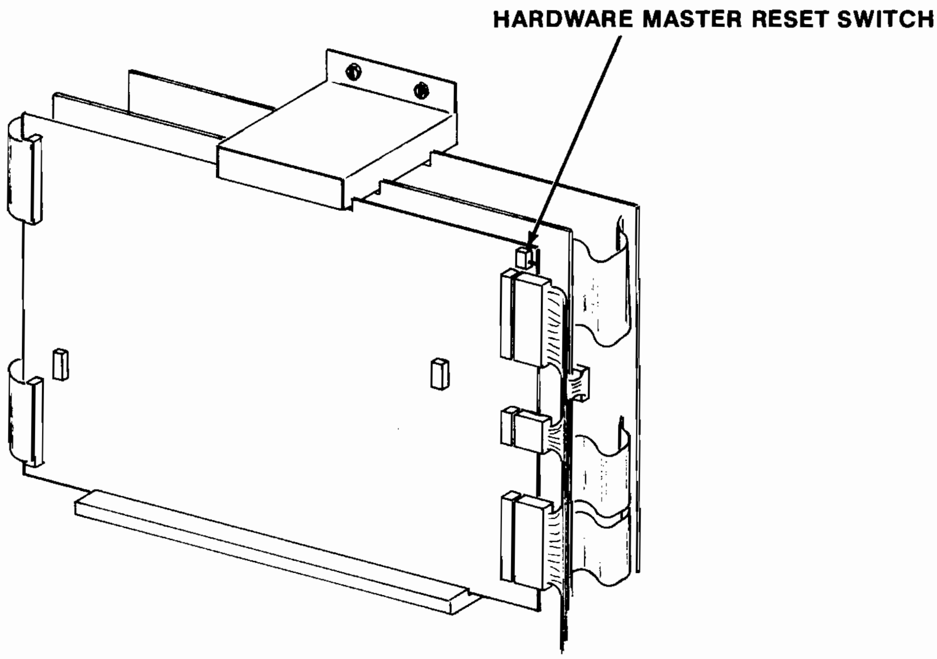
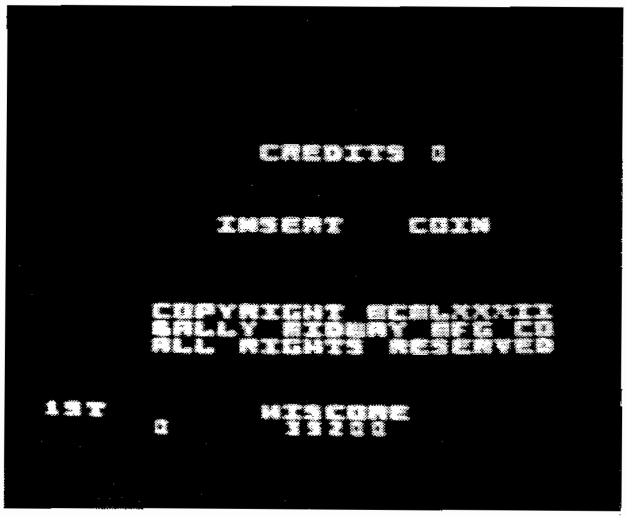


Figure 2-2 Location of Hardware Master Reset Switch

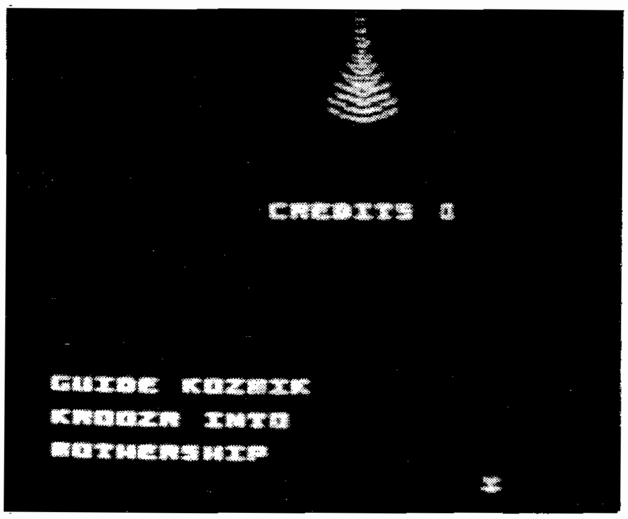
ATTRACT MODE

1. The Attract mode starts:

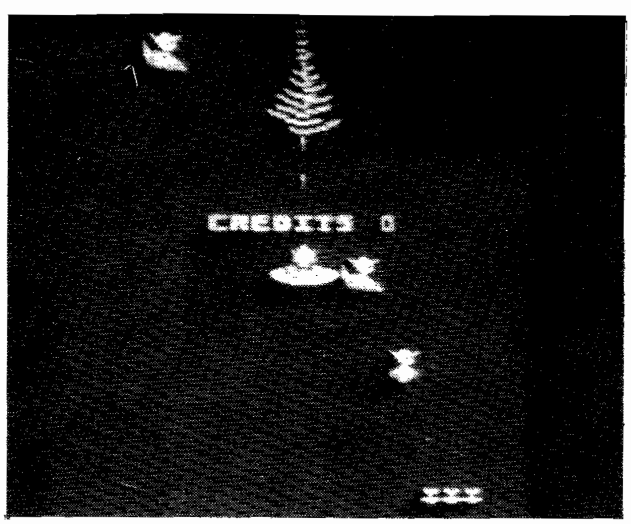
- ☐ Just after power has been turned on to the game. (Self-Test switch is in the "OFF" position.)
- ☐ After a Self-Test has been completed and there are no more credits left in the game's memory.
- ☐ After a play has been finished, the score was not high enough to put the game into the High Score/Initial mode, and there are no more credits left in the game's memory.
- ☐ After the High Score/Initial mode when there are no more credits left in its memory.
- ☐ In the Attract mode, the game will give the following displays **centered** on the monitor screen:



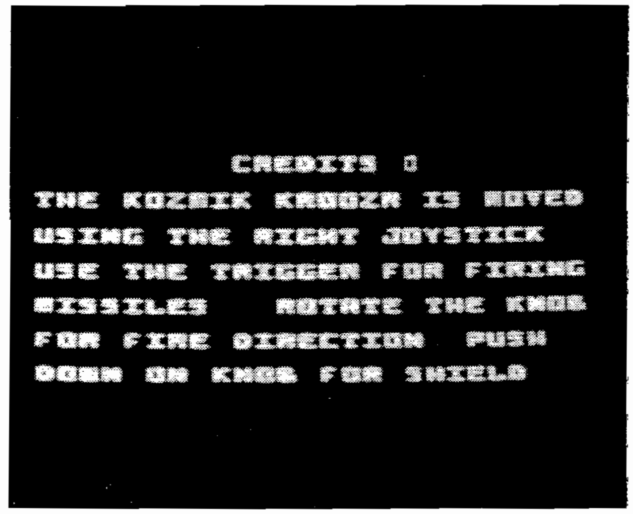
Attract Mode Display 1



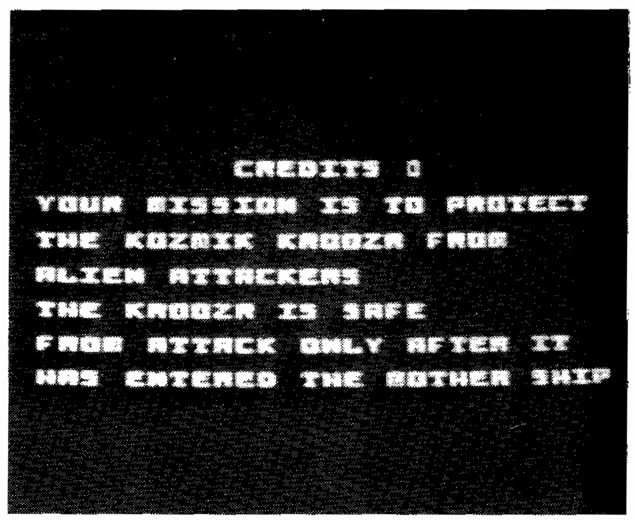
Attract Mode Display 2



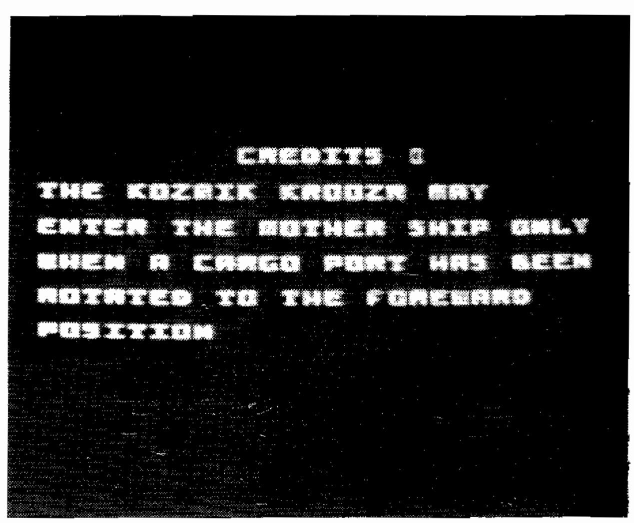
Attract Mode Display 3



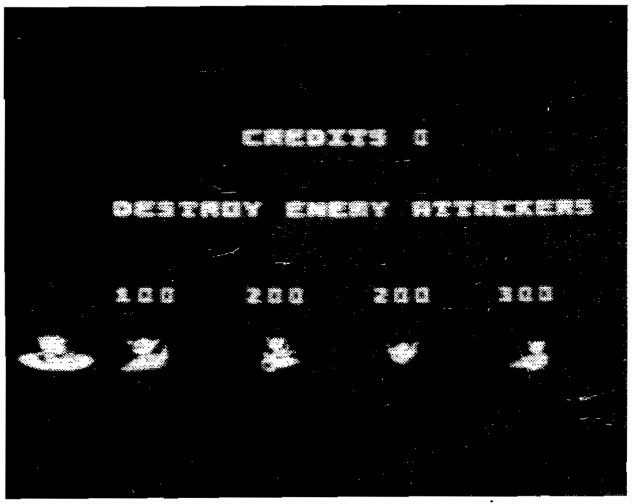
Attract Mode Display 4



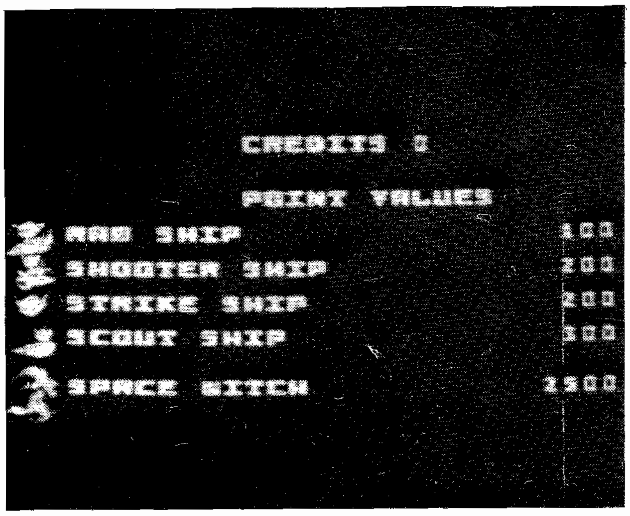
Attract Mode Display 5



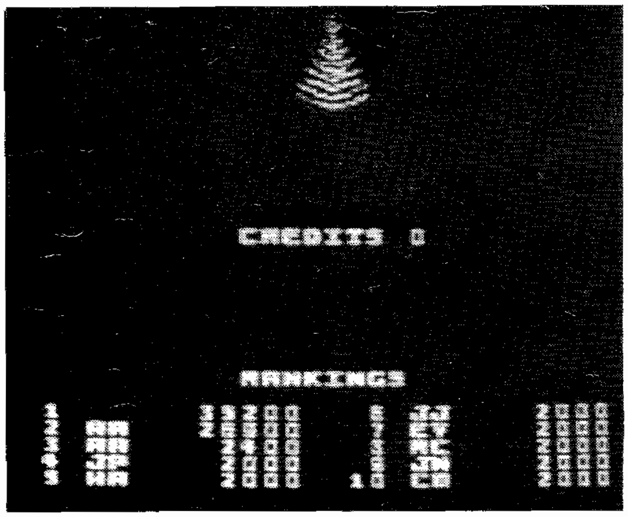
Attract Mode Display 6



Attract Mode Display 7

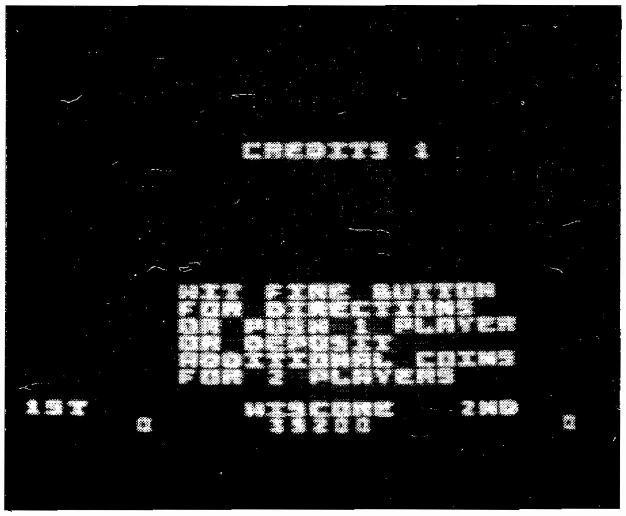


Attract Mode Display 8

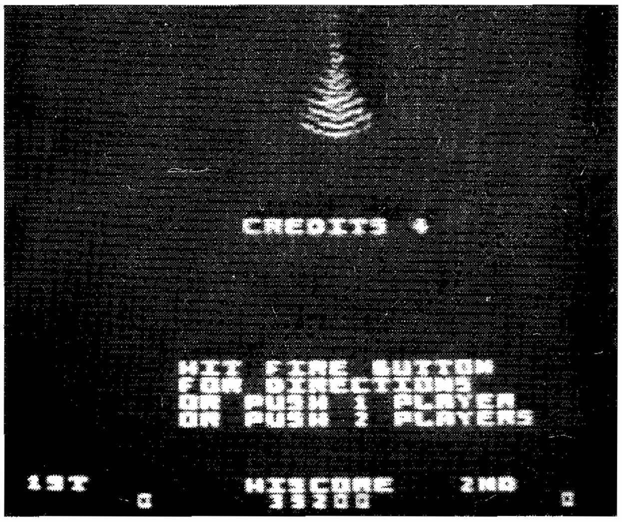


Attract Mode Display 9

☐ No matter where the game is in the Attract mode sequence, it will immediately go to the following display as soon as a game has been paid for.



Ready to Play Mode Display 1



Ready to Play Mode Display 2

READY-TO-PLAY MODE

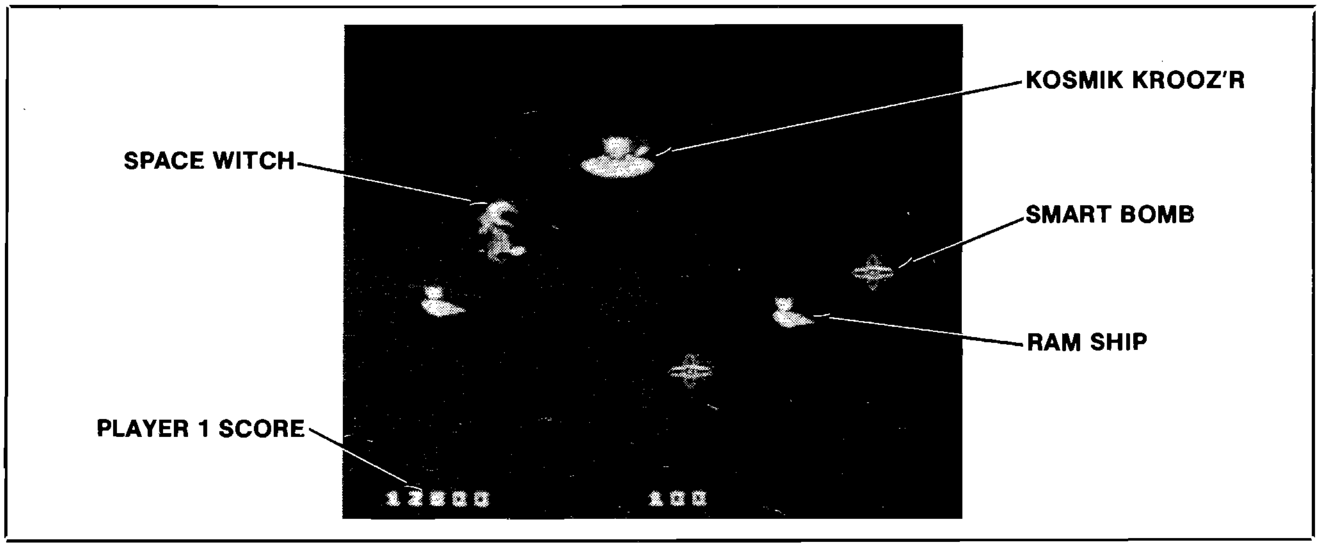
1. The Ready-To-Play mode starts when enough coins have been accepted for a 1 or 2 player game.
2. The Ready-To-Play mode ends when either the "1 PLAYER" or the "2 PLAYER" push button is pressed.
3. In the Ready-To-Play mode, the game will give the above displays **centered** on the monitor screen.
4. If no START button is pressed, the displays will remain indefinitely as shown above.

PLAY MODE

1. The Play mode begins when either the "1 PLAYER" or "2 PLAYER" start button is pressed.
2. The Play mode ends when all of your SHIPS have been eliminated. When this happens, "GAME OVER" is written across the center of the monitor screen.
3. **ON THE SCREEN:** The game is made up of 20 racks which increase in difficulty as you go along. After the 20th rack has been completed, the game repeats the basic format for rack #1 but adds some additional obstacles that were not there the first time you played it.

   At the beginning of each rack, the game tells which player is up.

   Also indicated in each rack is that rack's number, the number of players (1 or 2), a running total of the player's score(s), time left on shield, and the highest game score to date.
4. **PLAY BEGINS:** Your SHIP appears at the bottom of the screen, after all other objects have appeared. Play then begins for your SHIP. Your SHIP is protected for the first few seconds after it has appeared. This is indicated by its flickering image — protection ends when the image solidifies.
5. **ENEMY SHIPS/MINES/SPEED DEMONS, ETC.:** Initially, you will experience only one type of attacker at any one time per rack. In later racks, you will have several different types of attackers per rack coming at you at any one time. The characteristics of each attacker are different. All the Enemy SHIPS/MINES/SPEED DEMONS, ETC. listed in the scoring table will eventually appear during the game course. Certain ones only appear in the higher, more difficult, racks; and/or, if you spend too much time in any one rack. As your abilities improve, you'll find out which these are.
6. **BLACK HOLE:** The BLACK HOLE is one of those little surprises I was telling you about above. It appears if you should spend too much time in any one rack — or — when your skills have improved enough to reach the upper racks. When it latches on to your SHIP, it will take it all over the screen for about 15 seconds. During this time you still are able to fire your SHIP'S weapon and to use your shield, but you have **NO** control over your direction on the screen.
7. **SMART BOMBS:** These appear randomly as atom-like shapes and move randomly over the screen. While doing this they alternate colors between green and blue. If shot when they are green, they will explode and wipe out everything on the screen EXCEPT your SHIP. If shot when they are blue, nothing happens. Also, touching them with your SHIP at any time will cause **NO** problems.
8. **MISSILE FIRE:** This is done by pulling the trigger of your joy stick. Pull and release — one missile is fired. Pull and hold — four missiles are fired — short pause — four more missiles are fired, and so on.
9. **MISSILE AIMING:** Rotating the knob on the left side of the control panel will aim your SHIP'S launcher in any of 8 directions.
10. **SHIELD:** Your SHIP'S shield is activated by pushing down on the MISSILE AIMING knob. The shield does not last very long so be careful how you use it. It can only be recharged by guiding your SHIP inside the mother ship through one of its rotating ports. Your shield time is displayed at the bottom center of the screen.
11. **SHIP:** Your SHIP can move LEFT, RIGHT, UP, and DOWN on the screen. Its movements are controlled by the joy stick on the game's control panel.



Display of "On-Screen" Graphics During Game Play

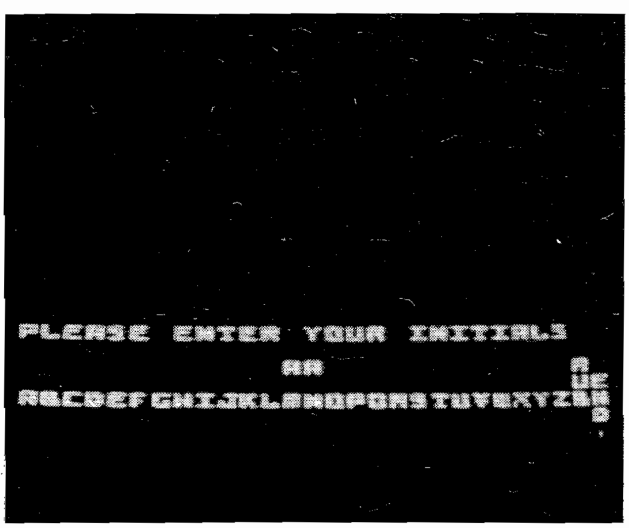
12. **KOZMIK JUNK YARD:** This is a BONUS RACK. It appears every fifth rack (5th, 10th, 15th, 20th, etc.). You **CANNOT** loose a SHIP here. There are four parts scattered throughout the junk yard for you to pick up before the time limit runs out. If you get all four, you can get an extra SHIP awarded to you.

    There are hazards in the junk yard that can slow you down. The chief one of these is the trails of space turbulence caused by passing asteroids. You cannot maneuver across them. There is also a talking inhabitant of the junk yard that will detect your presence and bend your ear if you get too close to his residence. And once this happens, you won't be able to get away until he's done talking.

13. **BONUS SHIPS:** These can be awarded to the player as he reaches or passes certain preselected point values. This feature is adjustable by the game's Owner/Operator.

14. **PLAY ENDS:** When your last SHIP is eliminated, "GAME OVER" is written across the center of the monitor screen.

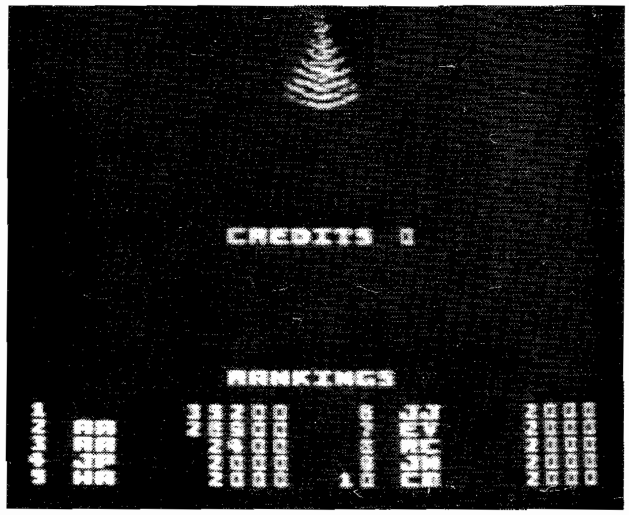
15. **HIGH SCORE/INITIAL MODE:** If your score was high enough to become one of the ten best scores, the game will go into the High Score/Initial mode immediately after the above display. If your score is not high enough to cause the game to go into the High Score/Initial mode, it will either go to the Attract mode (if there are no more credits left in its memory) or into the Ready-To-Play mode (if there are still credits left in its memory). In the High Score/Initial mode the game gives a display which looks like that shown below.



High Score/Initial Mode

Follow the ON-SCREEN instructions to enter your initials next to your score in the league of the best ten players to date.

When you've printed out your last initial, move the cursor opposite the "END" word and activate the same control you did to enter your initials. This tells the game you are through printing out your initials. The game will then give the following RANKINGS display showing your score opposite your ranking and your initials. See below.



Rankings Display

NOTE: If you don't tell the game you are through printing out your initials as instructed above, the game will automatically go into the RANKINGS display after a short wait.

After the High Score/Initial mode, the game will either go to the Attract mode (if there are no more credits left in its memory) or into the Ready-To-Play mode (if there are still credits left in its memory).

16. Most of the above holds true in the "2 PLAYER" mode also. But there are a few minor differences.

TWO PLAYER OPERATION

The Upright models all have two player operation.

In the two player mode, the rules of play are the same as in the single player mode. There are some additional rules, however.

1. The players must take turns at the controls.
2. Your turn lasts until:
   A. Your SHIPS are ALL eliminated.
   B. Your SHIPS have ALL entered the mother ship.

SHIP ELIMINATED — OTHERS REMAINING IN RESERVE

- ☐ The game stops and your next SHIP is displayed on the screen.
- ☐ Game play then resumes for you.

YOUR LAST SHIP ENTERS THE MOTHER SHIP

- ☐ Your SHIPS are returned to you and bonus points for each returned SHIP are displayed on screen.
- ☐ Next, the game indicates the other PLAYER is up, that player's pattern and SHIP appear on the monitor screen, and game play begins for that PLAYER.
- ☐ This PLAYER'S turn will last until either ALL his SHIPS are eliminated or until they all enter the mother ship.

SHIP ELIMINATED — NO OTHERS REMAINING IN RESERVE

- ☐ Game displays: "PLAYER ___" "GAME OVER" on the monitor screen.
- ☐ Next, if your score was high enough, the game will go into the HIGH SCORE/INITIAL mode. After this, it will indicate that the remaining PLAYER is up, that player's pattern and SHIP appear on the monitor screen, and game play begins for him.
- ☐ If your score was not high enough to cause the game to go into the HIGH/SCORE INITIAL mode, it will indicate that the remaining PLAYER is up, that players pattern and SHIP appear on the monitor screen, and game play begins for him.

LAST PLAYER'S SHIP ELIMINATED — NO OTHERS REMAINING IN RESERVE

- ☐ Game displays: "PLAYER ___" "GAME OVER" on the monitor screen.
- ☐ Next, if your score was high enough, the game will to into the HIGH SCORE/INITIAL mode and then either to the Attract mode (if there are no more credits left in its memory) or into the Ready-To-Play mode (if there are still credits left in its memory).
- ☐ If your score was not high enough to cause the game to go into the HIGH SCORE/INITIAL mode, the game will either go to the Attract mode (if there are no more credits left in its memory) or into the Ready-To-Play mode (if there are still credits left in its memory).

III. Maintenance and Repair

Your **NEW** game needs certain types of maintenance to keep it in good working order. **CLEAN,** well **MAINTAINED** games **attract players** and **EARN MORE PROFITS.**

The most important thing for you to remember is to run the Self-Test EVERY TIME you collect money from the coin box. **JUST LOOKING** at your game **WILL NOT** tell you if all its controls and inside parts are working correctly. The Self-Test will inform you whether or not your game is working the way it should.

The second most important thing you should remember is to clean the outside of the game and coin acceptor mechanisms on a regular basis.

CLEANING

The outside of the game cabinet plus the metal can be cleaned with any non-abrasive household cleaner. However, the front of the T.V. monitor tube and **both sides** of all other glass and plastic on or in the game MUST be cleaned with anti-static cleaner **ONLY.** For cleaning the coin acceptors: hot soapy water may be used on the plastic ones and any household cleanser may be used on the metal ones. If you wish, special coin machine cleaners that leave no residue may be purchased from your distributor.

DO NOT dry-wipe any of the plastic panels. This is because any dust that was on them can scratch their surfaces. If this has happened, anyone looking through this type of damaged plastic would feel he was looking at the game through a fog. This fogging damage CANNOT be repaired or reversed. The ONLY solution is to **replace** the damaged piece of plastic.

FUSE REPLACEMENT

This game contains several fuses located as shown in Figure 3-1.

1. UPRIGHT MODEL:

As viewed from the back, facing the cabinet, with the rear access door(s) removed; the fuses are located on the Power Chassis and the Power Supply P.C. Board.

Replace fuses **ONLY** with the type and size listed in the Illustrated Parts Breakdown Section of your manual.

See the T.V. Monitor Manual (available on request from your distributor or the monitor manufacturer) and/or the T.V. Troubleshooting Section of this manual for information on these fuses.

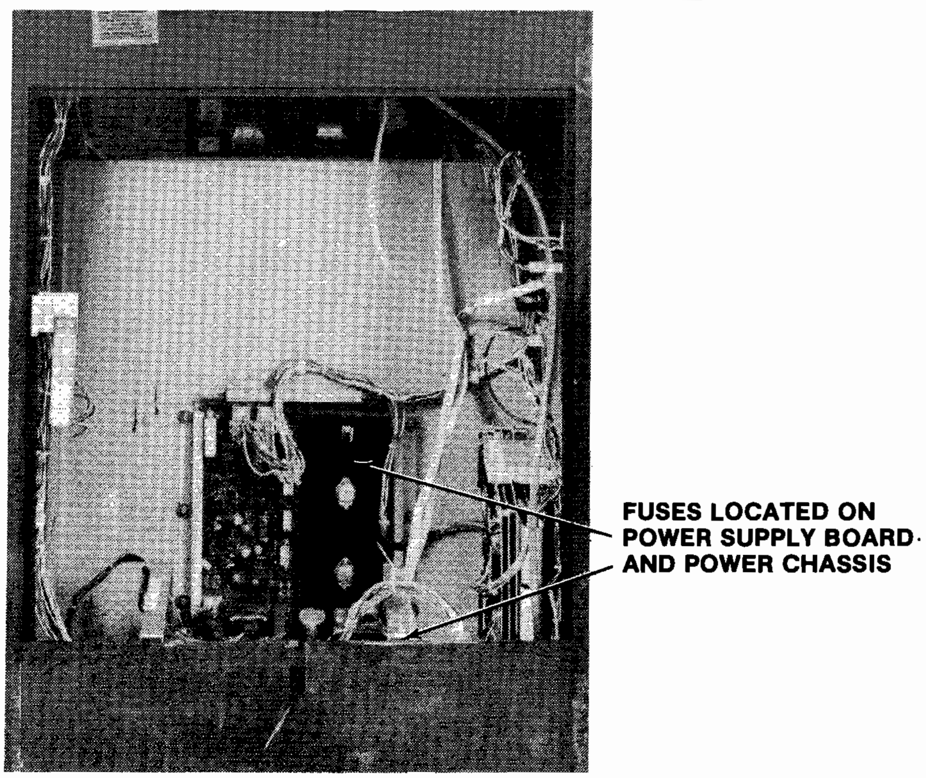


Figure 3-1 Location of Fuses

OPENING THE CONTROL PANEL

1. UPRIGHT MODEL: See Figure 3-2.

☐ The control panel is held in place by a nylon retaining strap and three latches, one on each side and one in the center at its back edge.

They are spring loaded to provide constant positive pressure on their latch plates.

They can be reached through the coin door **AFTER turning power to the game off.**

To release the latches, lift up and toward the front center of the control panel.

Once they are released, unhook them from their latch plates.

☐ To remove the control panel:

Raise it up and tilt it toward you until you can see the cable and nylon retaining strap behind it.

Cradling the control panel between yourself and the cabinet, disconnect it from its cabling and nylon retaining strap.

The control panel is now free and can be removed.

☐ To reinstall the control panel, reverse this procedure.

REMOVAL OF THE MAIN-DISPLAY-GLASS AND/OR THE T.V. BEZEL ASSEMBLY

1. UPRIGHT MODEL:

☐ **Turn the power to the game off** and remove the screws which secure the glass clamping plate in position. See Figure 3-3.

☐ Lift out the glass clamping plate. This frees the main-display-glass so it can be lifted up.

☐ By putting your finger in the hole in the middle of the main-display-glass support, you can lift it up and out.

☐ To reinstall the main-display-glass and glass clamping plate, reverse this procedure.

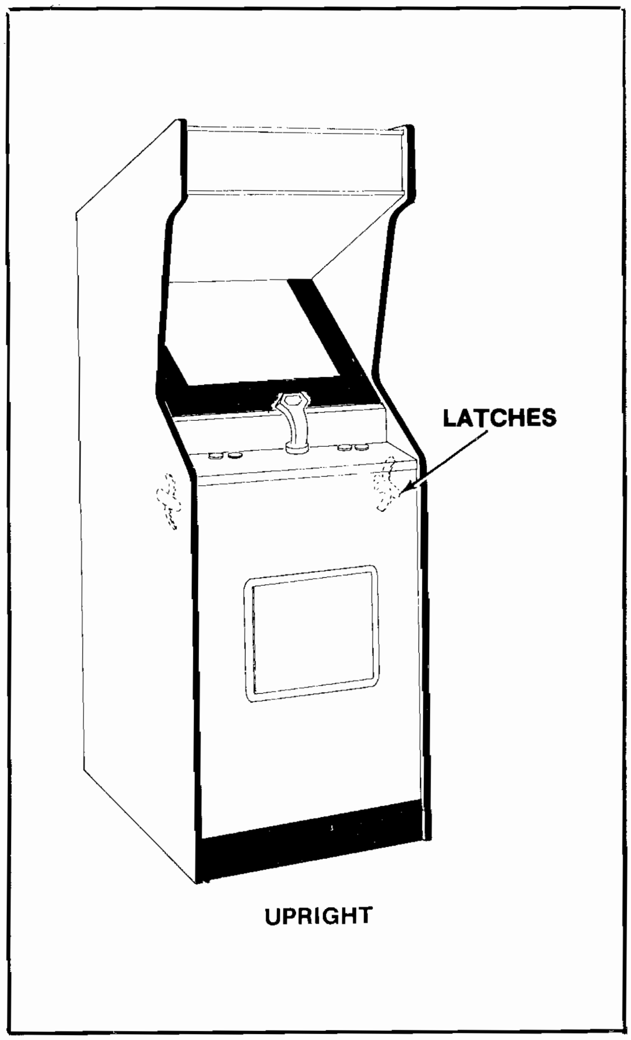


Figure 3-2 Opening the Control Panel

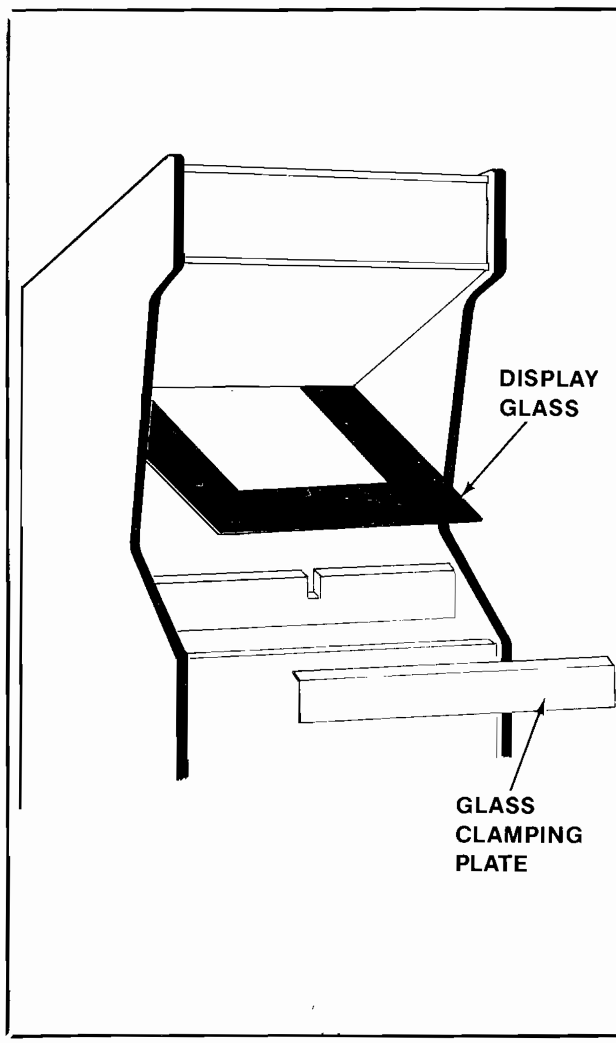


Figure 3-3 Removing the Main-Display-Glass & T.V. Bezel

T.V. MONITOR REPLACEMENT

CAUTION: High voltages may exist in any television unit, even with the power disconnected. Use EXTREME CAUTION and do not touch electrical parts or the T.V. yoke area with your hands or with metal objects held in your hands!

In addition, BE SURE TO USE HEAVY GLOVES when handling the monitor. You could cut your hands on the metal T.V. chassis without such protection.

DANGER: The T.V. monitor DOES NOT contain an isolation transformer on its chassis (it is mounted instead on the floor of the cabinet). When servicing the monitor on a test bench, YOU MUST ISOLATE THE MONITOR FROM AC VOLTAGE WITH AN ISOLATION TRANSFORMER.

1. UPRIGHT MODEL: See Figure 3-4.

☐ **Turn power off to the game.**

☐ Open the rear access doors.

☐ Completely disconnect the T.V. monitor from all its cabling. **DON'T FORGET THE CHASSIS GROUND WIRE.**

☐ With the removal of only four bolts, the T.V. monitor will be loose.

CAUTION: BE SURE to support the T.V. monitor from the rear while removing the four bolts so it will not slip.

☐ The monitor mounting bars slide on top of and against two metal guides mounted to the cabinet's right and left sides. The monitor is removed by sliding it out the back of the cabinet. See Figure 3-4.

☐ To reinstall the T.V. monitor, reverse this procedure.

☐ After replacing the T.V. monitor, be sure to run the game Self-Test.

PRINTED CIRCUIT BOARD (P.C.B.) REPLACEMENT

1. UPRIGHT MODEL: See Figure 3-4.

☐ **Turn the power to the game off.**

☐ Unlock and open the rear access door(s).

☐ Disconnect all cabling from the P.C. boards and lift them out of their card rack.

☐ Disconnect the linear power supply board from all its cabling, remove the P.C.B. support(s) indicated in Figure 3-5, and slide the linear power supply board out the back of the cabinet.

☐ To reinstall the above P.C.B.'s, reverse this procedure.

NOTE: P.C.B.'s are all keyed and will ONLY fit into their connectors one way without forcing them. The plugs on the cable harness which connect it to the P.C.B.'s are also keyed and will ONLY go onto their connectors one way without forcing them.

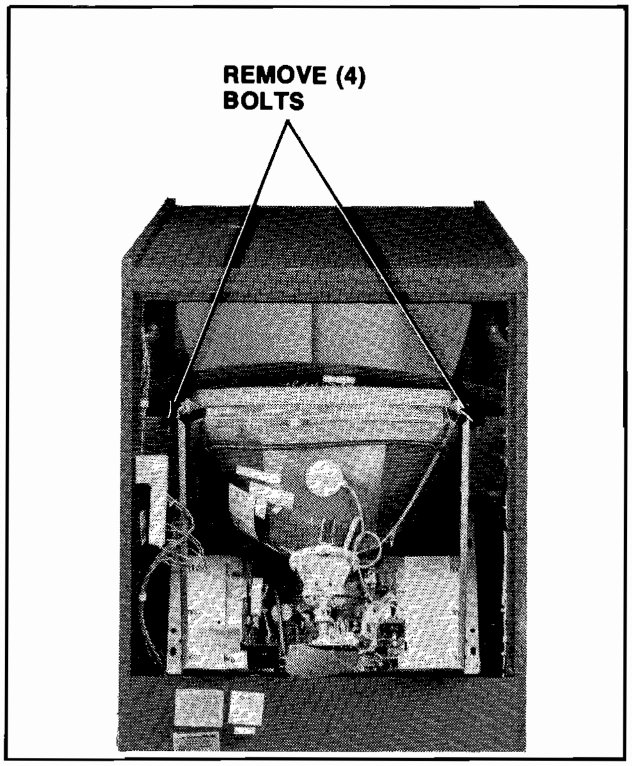


Figure 3-4 Removing the Monitor

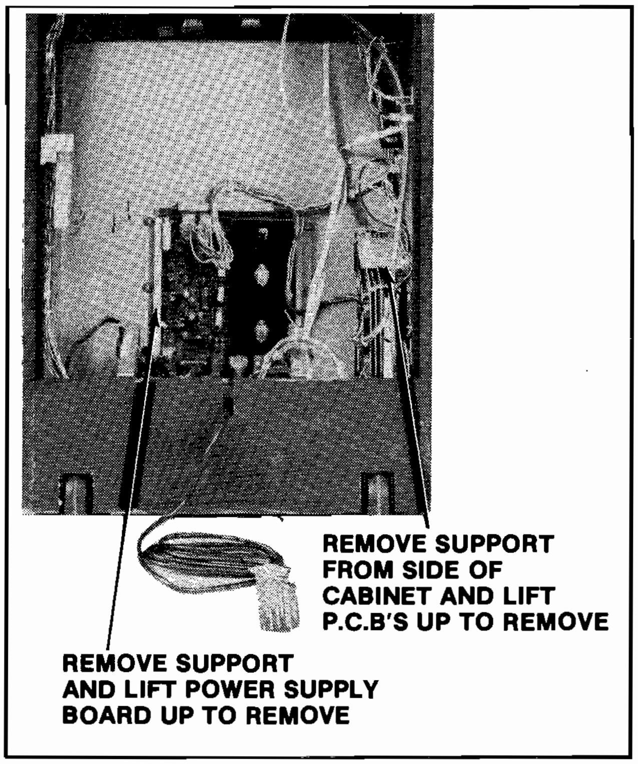


Figure 3-5 Removing the P.C.B.'s

OPENING THE ATTRACTION PANEL

1. UPRIGHT MODEL:

- ☐ **Turn the power to the game off.**
- ☐ Opening the attraction panel:

  Remove the screws which secure the top bracket in place. (They are on its top side.) See Figure 3-6.

  Remove the top bracket and slide up the attraction panel. This exposes the speakers, fluorescent tube, and their mountings.

  To reinstall the attraction panel, reverse this procedure.
- ☐ The fluorescent light tube may be replaced at this time. BE CAREFUL NOT TO DROP IT.

WARNING: If you drop a fluorescent tube and it breaks, IT WILL IMPLODE! Shattered glass can fly six (6) feet or more from the implosion. Use care when replacing any fluorescent tube.

- ☐ Replacing the fluorescent light tube starter. See Figure 3-7.

  Be sure the power to the game has been turned off.

  Grasp the starter (it is on the back of the mounting bracket), give it a quarter turn, and remove it from its socket.

  To replace the fluorescent light tube starter, reverse this procedure.
- ☐ Removing the speaker(s):

  The attraction panel **MUST** be removed first. This will enable you to reach all the necessary areas where cables **MUST** be disconnected.

  Disconnect the speaker(s) from all their cabling.

  Remove the screws which secure the speaker grill to the cabinet.



Figure 3-6 Opening the Attraction Panel

  The speaker attachment nuts and bolts may now be removed and the speaker(s) taken out of the cabinet through the hole in the front of the game where the attraction panel was mounted.

  To reinstall the speaker(s) and speaker grill, reverse this procedure.
- ☐ Replacement of the fluorescent tube mounting bracket assembly.

  Disconnect it from its power cable.

  Remove the screws which secure it to the cabinet.

  To reinstall the fluorescent tube mounting bracket, reverse this procedure.

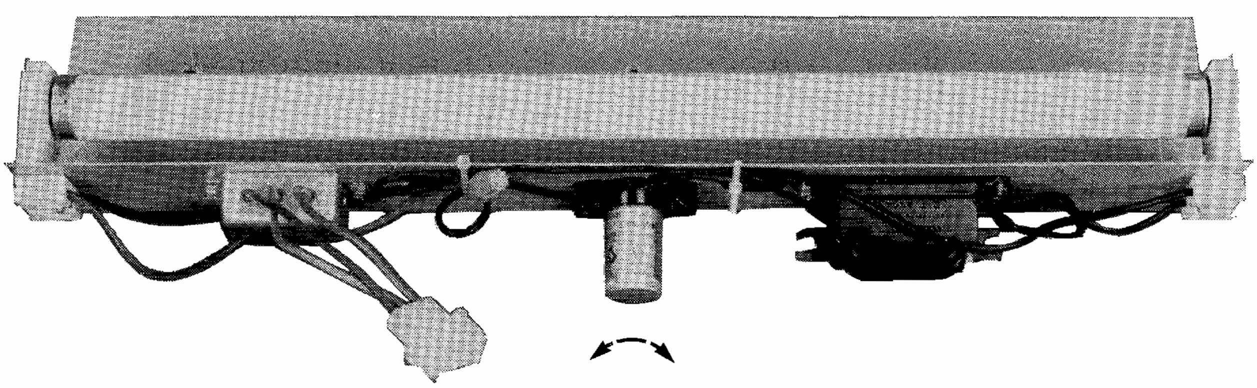


Figure 3-7 Replacing Flourescent Tube Starter

SERVICING THE BLACK LIGHT ABOVE CONTROL CONSOLE

1. UPRIGHT MODEL:

- ☐ **Turn the power to the game off** and remove the screws which secure the glass clamping plate in position. See Figure 3-8

  Lift out the glass clamping plate.

  Remove the screws which secure the bottom of the black light shield to the front service panel.

  BE SURE you support the black light shield as you remove these screws so it will not fall on the floor.

  The black light tube may be replaced at this time. BE CAREFUL NOT TO DROP IT.

WARNING: If you drop a black light tube and it breaks, IT WILL IMPLODE! Shattered glass can fly six (6) feet or more from the implosion. Use care when replacing any black light tube.

To reinstall the black light shield, reverse this procedure.

- ☐ Replacing the black light tube starter. See Figure 3-7.

  NOTE: The main-display-glass **MUST** be removed in order to do this. See "Upright Model" procedure.

  Be sure the power to the game has been turned off.

  Grasp the starter (it is on the back of the mounting bracket, just inside the frame for the main-display-glass), give it a quarter turn, and remove it from its socket.

  To replace the black light tube starter, reverse this procedure.

SERVICING THE FLUORESCENT LIGHT BEHIND THE FRONT SERVICE PANEL

- ☐ Remove the front service panel.

  Turn the power to the game off.

  NOTE: In order to do this, the following items **MUST** be removed first, in this order, to make room: 1) the main-display-glass glass clamping plate; 2) the black light shield; and 3) the control panel. See the appropriate sections of this manual for removal instructions.

  Remove the screws at the top of the front service panel which secure it to the cabinet.

  Tilt it back to clear the black light and lift it up and out as shown in Figure 3-8.

  To reinstall the front service panel, reverse this procedure.

- ☐ The fluorescent light tube may be replaced at this time. BE CAREFUL NOT TO DROP IT.

WARNING: If you drop a fluorescent tube and it breaks, IT WILL IMPLODE! Shattered glass can fly six (6) feet or more from the implosion. Use care when replacing any fluorescent tube.

- ☐ Replacing the black light tube starter. See Figure 3-7.

  Be sure the power to the game has been turned off.

  Grasp the starter (it is on the back of the mounting bracket, give it a quarter turn, and remove it from its socket.

  To replace the fluorescent light tube starter, reverse this procedure.

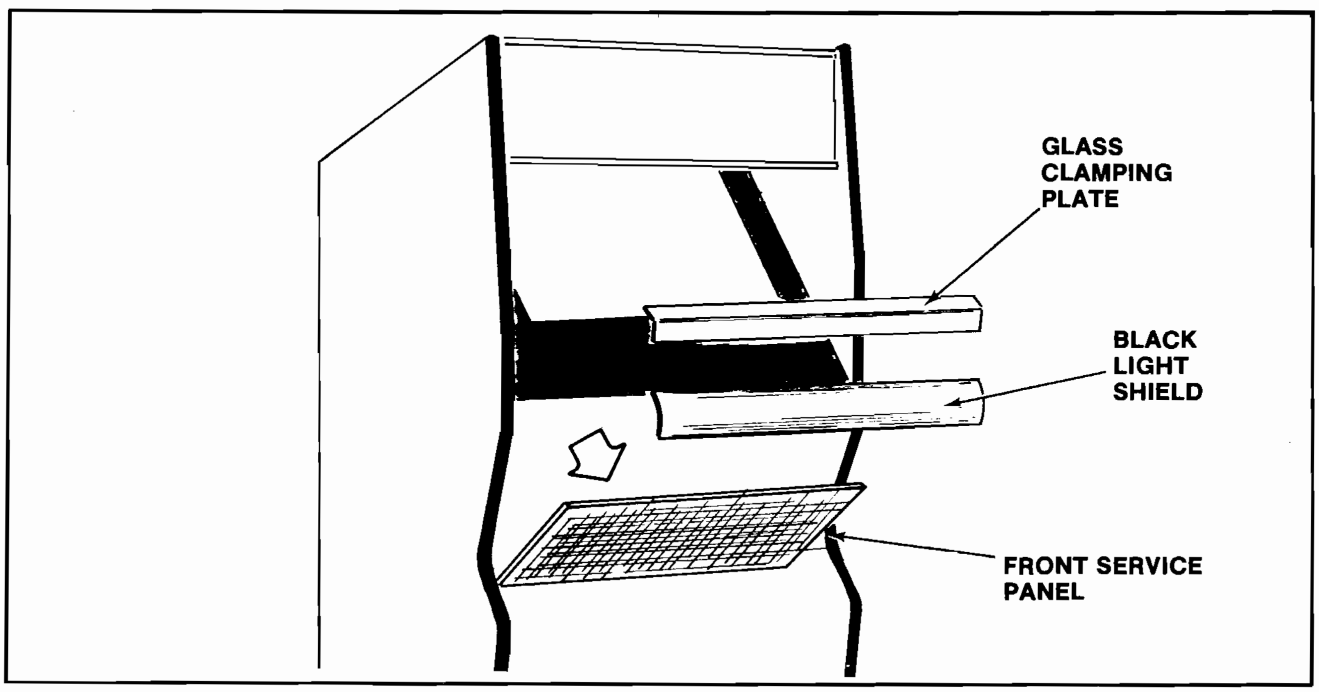
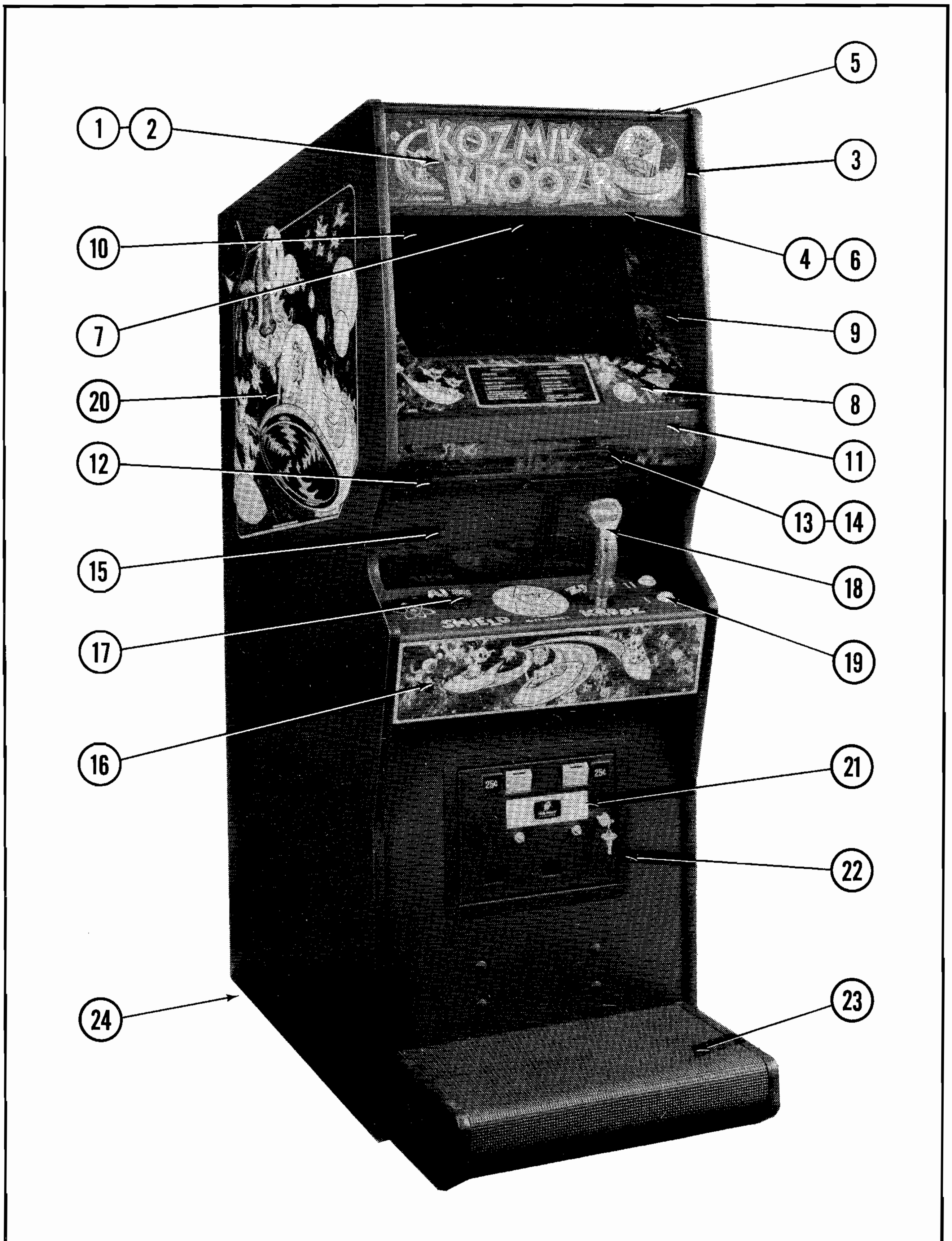


Figure 3-8 Servicing Center Auxiliary Lighting

IV. Illustrated Parts Breakdown

NO. 639 — KOZMIK KROOZ'R — FRONT



NO. 639 — KOZMIK KROOZ'R — FRONT — PARTS LIST

*ORDER BY PART NUMBER **ONLY***

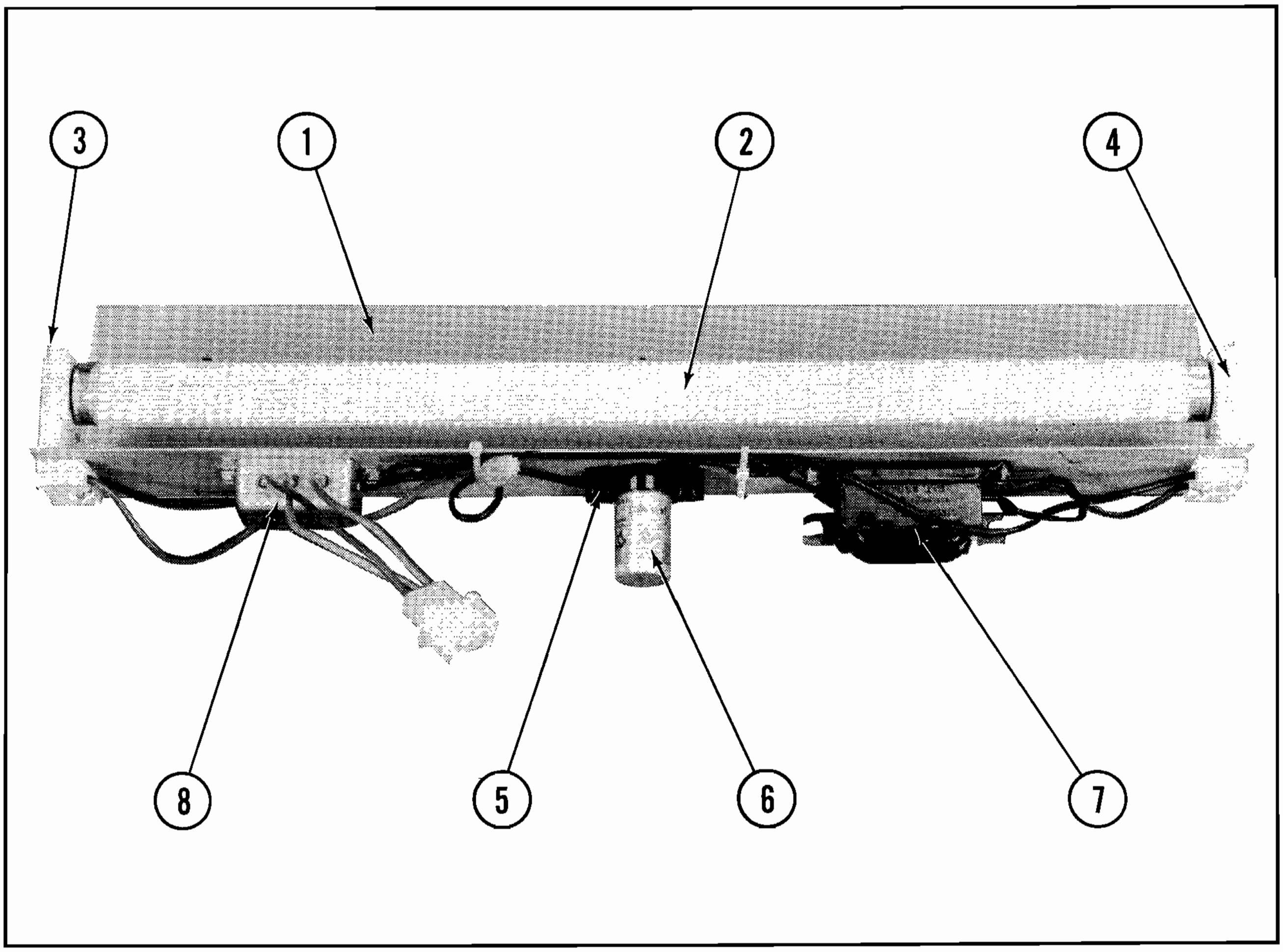
ITEM	PART NO.	DESCRIPTION
1	0639-00909-00XF	DISPLAY HEADER
2	A639-00030-0000	HEADER FLUOR. LIGHT ASSY.
3	0537-00903-0066	GLASS CHANNEL — 5-7/8" LG. (2 REQ'D.)
4	0537-00903-0004	GLASS CHANNEL — 22-1/4" LG.
5	0574-00903-0100	HEADER RETAINING BRKT.
6	0639-00111-00XF	RETAINER GRILL
	0017-00101-0138	#8 x 5/8 TORX TAMPER RESISTANT BLK. SCR. (16 REQ'D.)
7	0017-00003-0430	6" x 9" SPEAKER — 4 OHM, 10W. (2 REQ'D.)
	0017-00101-0127	#8-32 x 1-1/2 CARRIAGE BOLT (8 REQ'D.)
	0017-00103-0061	#8-32 HEX NUT W/SEMS (8 REQ'D.)
	A639-00055-0000	SPEAKER CABLE ASSY.
8	0639-00907-00XF	MAIN VIEWING GLASS
9	0537-00903-0068	GLASS CHANNEL — 17" LG. (2 REQ'D.)
10	0537-00903-0034	GLASS CHANNEL — 23" LG.
11	0639-00102-00XF	DISPLAY GLASS RETAINER BRKT.
12	0639-00100-00XF	LAMP PROTECTOR MTG. BRKT.
13	0639-00902-0000	LAMP PROTECTOR
	0017-00101-0138	#8 x 5/8 TORX TAMPER RESISTANT BLK. SCR. (10 REQ'D.)
14	A639-00031-0000	BLACK LIGHT ASSY.
15	A639-00054-0000	ACCESS PANEL ASSY.
16	A639-00041-0000	OVERLAY TO WELDMENT ASSY.
	A639-00042-0000	CONTROL SHELF WELDMENT ASSY.
	0639-00919-0000	DECORATIVE OVERLAY
	0639-00124-0100	CONTROL SHELF MTG. BRKT. — LEFT
	0639-00124-0200	CONTROL SHELF MTG. BRKT. — RIGHT
	0555-00901-0000	PLASTIC LOCATING PIN (4 REQ'D.)
	0017-00009-0534	BASSICK CLAMP (3 REQ'D.)
	0017-00101-0141	#8 x 11/16 UNSLOT. HEX HD. SCR. (12 REQ'D.)
	0639-00127-0000	CONTROL SHELF LOCK BRKT.
17	A639-00034-0000	KNOB & SHAFT ASSY.
	A639-00043-0000	OPTICAL ENCODER DISC ASSY.
18	A628-00032-0000	GRIP W/SWITCH ASSY.
	A639-00023-0000	ANALOG CONTROL ASSY.
	A089-00020-0000	CONTROL GRIP CABLE ASSY. — 16" LG.
	A639-00008-0000	CONTROL SHELF CABLE ASSY.
19	0017-00042-0260	PUSH BUTTON ASSY. — WHITE (2 REQ'D.)
	0017-00032-0093	PUSH BUTTON SWITCH W/HOLDER (2 REQ'D.)
	0017-00103-0054	5/8-11 PAL NUT (2 REQ'D.)
20	0639-00920-0200	DECAL — LEFT SIDE
	0639-00920-0100	DECAL — RIGHT SIDE (NOT SEEN)
21	A090-00300-11BK	U.S.A. 25¢ DOUBLE COIN DOOR ASSY.
	A982-00015-0000	COIN DOOR CABLE ASSY.

NO. 639 — KOZMIK KROOZ'R — FRONT — PARTS LIST (Continued)

*ORDER BY PART NUMBER **ONLY***

ITEM	PART NO.	DESCRIPTION
22	0090-00002-04BK	LARGE COIN DOOR FRAME
	0017-00101-0121	#6-32 x 5/16 PHIL. TRS. HD. SCR. (3 REQ'D.) (MOUNTS COIN DOOR TO FRAME)
	0950-00004-0000	COIN BOX ASSEMBLY
	A950-00006-0000	COIN BOX CRADLE ASSY.
	0950-00105-0000	COIN BOX COVER
	0950-00104-0000	COIN BOX HANDLE
	0950-00101-0000	COIN DEFLECTOR (2 REQ'D.)
	0950-00900-0000	LARGE PLASTIC COIN BOX
	0950-00103-0000	COIN BOX DIVIDER — OPTIONAL
	0017-00101-0142	1/4-20 x 1-3/8 BLACK RND. HD. BOLT (4 REQ'D.)
	0017-00104-0014	7/8" DISH WASHER (4 REQ'D.)
	0017-00103-0018	1/4-20 HEX NUT (4 REQ'D.)
23	A639-00032-0000	STEP STOOL ASSY.
	0639-00910-0000	STEP STOOL MAT
24	0017-00102-0048	3/8-16 x 2" LEG LEVELERS (4 REQ'D.)
	0017-00103-0026	3/8-16 LEG LEVELER HEX NUTS (4 REQ'D.)

NO. 639 — KOZMIK KROOZ'R — UPRIGHT
HEADER FLUORESCENT LIGHT ASSY. & BLACK LIGHT ASSY.

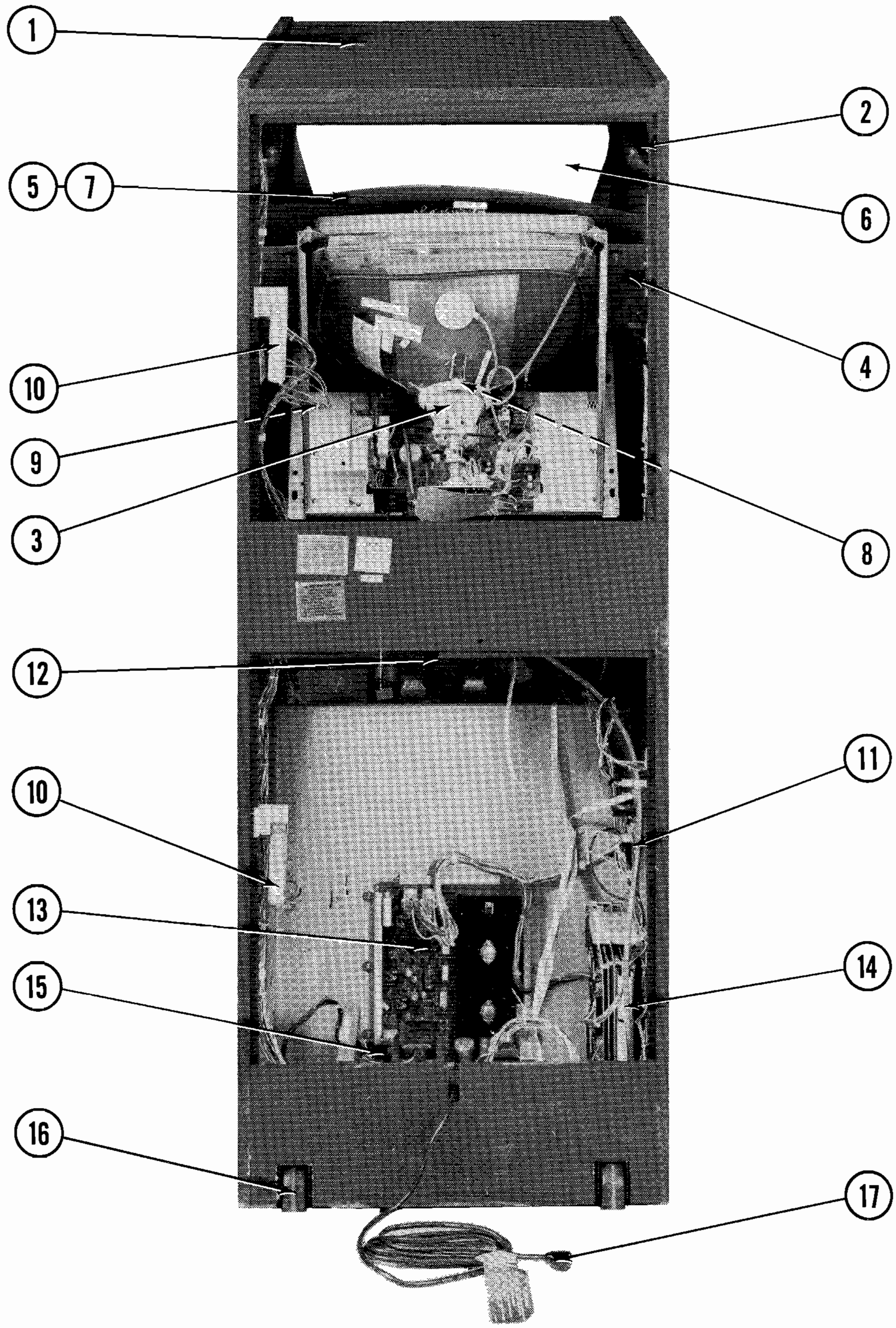


NO. 639 — KOZMIK KROOZ'R — UPRIGHT
HEADER FLUORESCENT LIGHT ASSY. & BLACK LIGHT ASSY. — PARTS LIST

ORDER BY PART NUMBER ***ONLY***

ITEM	PART NO.	DESCRIPTION
1	0639-00113-0000	HEADER FLUORESCENT BRKT.
1	0639-00107-0000	BLACK LIGHT BRKT.
2	0017-00003-0043	18" COOL WHITE FLUOR. LIGHT LAMP
2	0017-00003-0095	18" BLACK LIGHT LAMP
3	0017-00003-0445	LAMP LOCKS (2 REQ'D.)
4	0017-00031-0036	FLUORESCENT SOCKET (2 REQ'D.)
5	0017-00003-0412	FLUORESCENT STARTER HOLDER W/LEADS
	0017-00101-0573	#6-32 x 1/2 PHIL. RND. HD. M.S. (4 REQ'D.)
	0017-00104-0009	#6 EXT. WASHER (4 REQ'D.)
6	0017-00003-0019	FLUORESCENT STARTER
7	0017-00003-0026	BALLAST
	0017-00101-0598	#8-32 x 5/16 SLT. HEX HD. SCR. (4 REQ'D.)
8	A961-00042-0000	LINE FILTER ASSY.

NO. 639 — KOZMIK KROOZ'R — REAR ACCESS

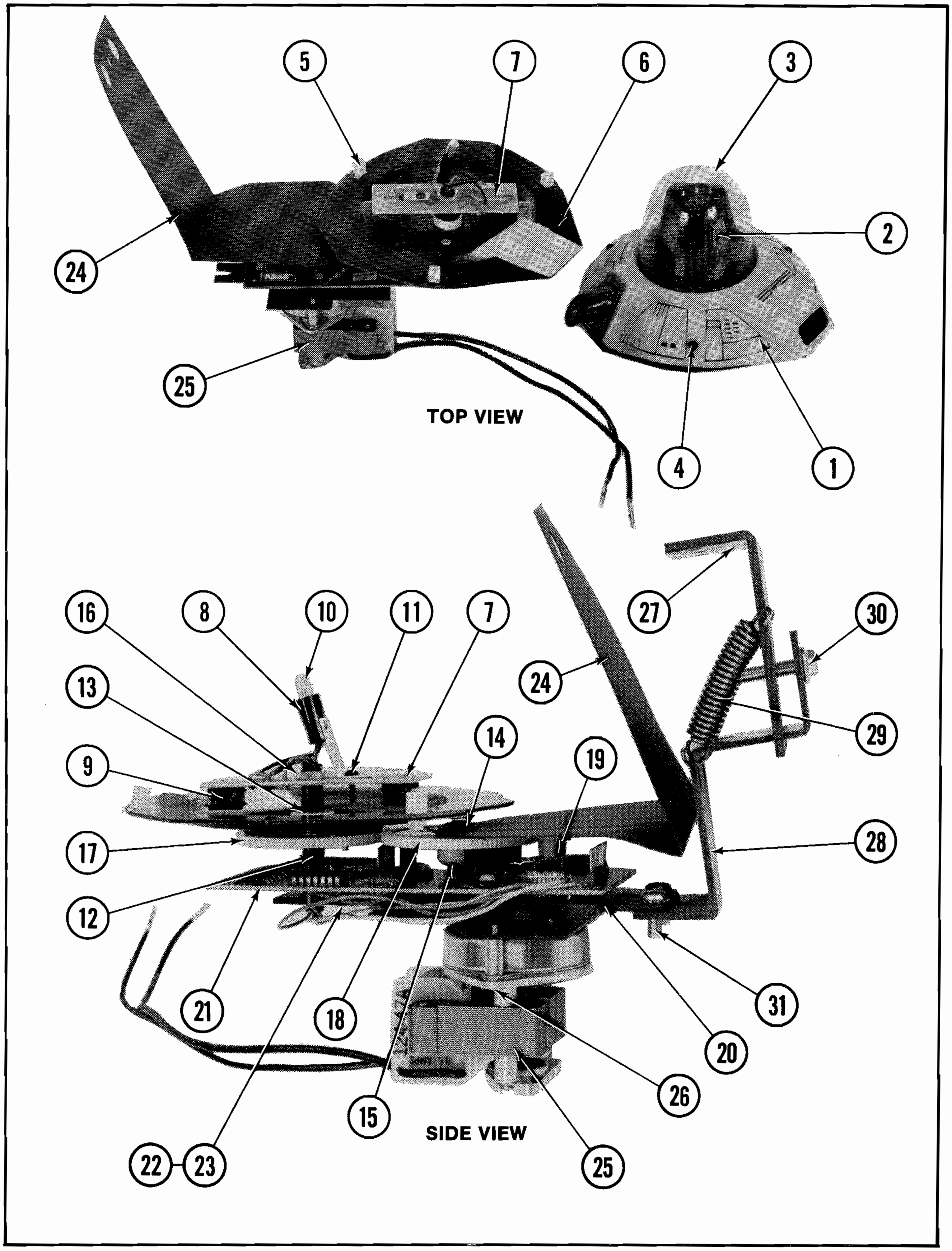


NO. 639 — KOZMIK KROOZ'R — REAR ACCESS — PARTS LIST

ORDER BY PART NUMBER ***ONLY***

ITEM	PART NO.	DESCRIPTION
1	A945-00038-0000	ON-OFF SWITCH & PLATE ASSY.
2	0894-00913-0000	RECESSED HAND LIFT (2 REQ'D.)
	0017-00101-0138	#8 x 5/8 TORX TAMPER RESISTANT BLK. SCR. (12 REQ'D.)
3	0017-00003-0339	ELECTROHOME — 19" COLOR DUAL SYNC HORIZ. MTG. MONITOR (OR)
3	0017-00003-0439	WELLS-GARDNER — 19" COLOR DUAL SYNC HORIZ. MTG. MONITOR (OR)
3	0017-00003-0454	ZENITH — 19" COLOR DUAL SYNCH HORIZ. MTG. MONITOR
4	0550-00100-0000	MONITOR RAIL (2 REQ'D.)
	0555-00901-0000	PLASTIC LOCATING PIN (4 REQ'D.)
	0017-00101-0141	#8 x 11/16 UNSLOT HEX HD. M.S. (8 REQ'D.)
	0017-00102-0066	1/4-20 x 3/4 UNSLOT. HEX HD. BOLT (4 REQ'D.)
	0017-00104-0014	7/8" DISH WASHER (4 REQ'D.)
5	0639-00908-0000	MONITOR BEZEL
6	0639-00901-0000	CURVED GLASS MIRROR
	0639-00112-00XF	MIRROR HOLD DOWN BRKT. (2 REQ'D.)
7	0639-00905-0000	DEEP SPACE SCENERY
8	A639-00045-0000	SHIP ASSEMBLY — NOT SEEN
	A639-00039-0000	ADJUSTMENT BRKT. ASSY.
9	A639-00037-0000	SPOT LIGHT ASSY. — NOT SEEN (2 REQ'D.)
10	A088-00016-0000	INTERLOCK SWITCH & SPRING BRKT. ASSY. (2 REQ'D.)
11	A084-90509-C000	SOLID STATE RELAY P.C. BOARD ASSY.
12	A082-90910-E000	DUAL POWER AMP P.C. BRD. ASSY.
	0017-00042-0014	1/8" SNAP BUSHING (4 REQ'D.)
	0017-00101-0751	#5-40 x 1/4 PHL. RND. HD. M.S. (4 REQ'D.)
13	A082-90412-D000	POWER SUPPLY P.C. BOARD ASSY.
	0624-00902-0100	P.C. SUPPORT BRKT. — 12" LG. (2 REQ'D.)
	0624-00902-0500	P.C. SUPPORT BRKT. — 6-1/2" LG. (2 REQ'D.)
	0317-00102-0000	P.C. MTG. BRACE BRKT. (4 REQ'D.)
	0017-00101-0141	#8 x 11/16 UNSLOT HEX HD. M.S. (12 REQ'D.)
	0017-00104-0037	#8 FLAT WASHER (12 REQ'D.)
14	A639-00005-0000	CARD RACK W/BOARDS ASSY.
	A084-90010-A639	C.P.U. P.C. BOARD ASSY.
	A084-91399-A639	VIDEO/GENERATOR P.C. BOARD ASSY.
	A084-91483-A639	SOUND I/O P.C. BOARD ASSY.
	A639-00060-0000	SHIELD & BARRIER ASSY.
	A639-00059-0000	INNER SHIELD & SPACER ASSY.
	A639-00061-0000	OUTER SHIELD & SPACER ASSY.
	0017-00101-0134	#6-32 x 1/4 PHIL. RND. HD. M.S. (8 REQ'D.)
	0017-00101-0153	#6-32 x 1" PHIL. RND. HD. M.S. (4 REQ'D.)
15	A945-00020-0000	POWER CHASSIS ASSY. — 125VA., 115V.
16	A961-00007-0000	CASTER ASSY. (2 REQ'D.)
17	A945-00019-0000	LINE CORD ASSY.
		ADDITIONAL PARTS LIST
	A097-00008-0000	BACK DOOR LOCK ASSY. (2 REQ'D.)
	0017-00009-0490	5-5/8" SQR. VENT GRILL — BACK DOOR (4 REQ'D.)
	A639-00010-0000	MASTER CABLE W/BRKT. ASSY.
	A639-00012-0000	HIGH VOLTAGE CABLE ASSY.
	A941-00008-0000	LOW VOLTAGE CABLE ASSY.
	A337-00018-0000	VIDEO SIGNAL CABLE ASSY.

NO. 639 — KOZMIK KROOZ'R — SHIP ASSEMBLY

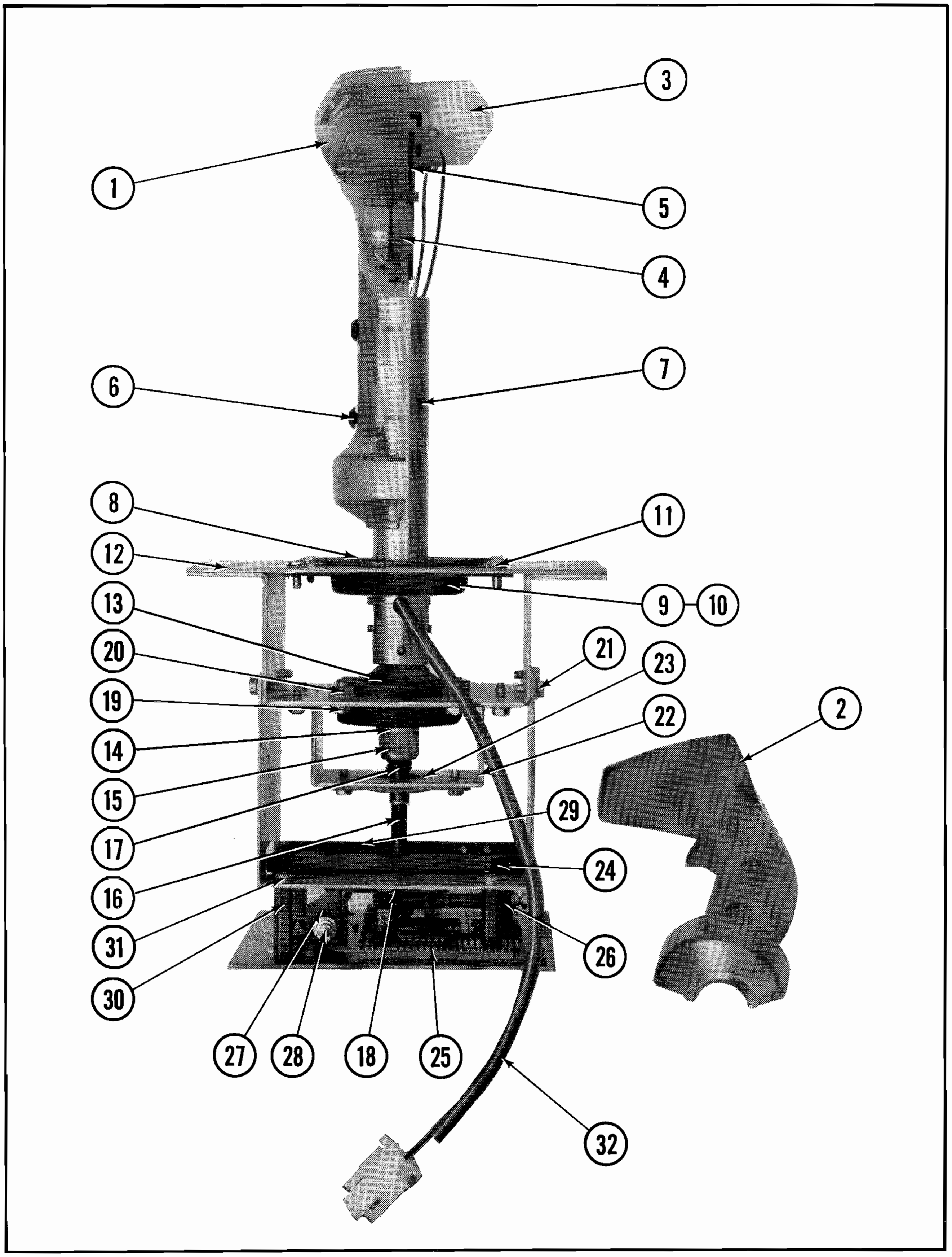


NO. 639 — KOZMIK KROOZ'R — SHIP ASSEMBLY — PARTS LIST

*ORDER BY PART NUMBER **ONLY***

ITEM	PART NO.	DESCRIPTION
1	0639-00918-0000	KOZMIK KROOZ'R
2	0639-00929-0000	COCKPIT
	0639-00927-0000	DECAL (3 REQ'D.)
3	0639-00912-0000	CANOPY
	A639-00051-0000	KOZMIK KROOZ'R BODY ASSY. (FIRST 3 ITEM NO'S.)
4	0017-00101-0159	#4 x 1/2 PHIL. RND. HD. BLACK SCREW (3 REQ'D.)
5	0017-00042-0327	PLASTIC GROMMET (3 REQ'D.)
6	0639-00917-0000	KOZMIK KROOZ'R MTG. BASE
7	A080-91478-B639	LAMP P.C. MTG. BOARD
8	0017-00031-0051	WEDGE BASE SOCKET W/LEAD
9	0017-00031-0046	WEDGE BASE SOCKET (2 REQ'D.)
10	0017-00003-0463	WEDGE BASE LAMP — 14V. (3 REQ'D.)
11	0017-00101-0001	#4 x 1/4 PHIL. PAN HD. SCR. (4 REQ'D.)
12	0639-00710-00XF	SPINDLE
13	0017-00100-0031	5/16" E-RING (2 REQ'D.)
14	0017-00100-0025	1/4" E-RING (2 REQ'D.)
15	0017-00104-0094	PLASTIC FLAT WASHER (3 REQ'D.)
16	0017-00103-0069	5/16-24 HEX NUT (2 REQ'D.)
17	0639-00914-0000	GEAR
18	A639-00047-0000	GEAR & FLAG ASSY.
19	A639-00038-0000	ADAPTOR ASSY.
20	A639-00040-0000	MTG. BRKT. ASSY.
21	A084-91434-D639	SENSOR P.C. BRD. ASSY.
22	0017-00042-0326	PLASTIC GROMMET (2 REQ'D.)
23	0017-00101-0014	#6 x 1/2 SLT. HEX HD. SCR. (2 REQ'D.)
24	0639-00923-0000	P.C. BRD. SHIELD
25	A639-00056-0000	MOTOR & CONNECTOR ASSY.
26	0017-00101-0528	#5-40 x 3/4 PHIL. RND. HD. M.S. (2 REQ'D.)
27	0639-00118-00XF	MTG. BRKT.
28	0639-00121-00XF	ADJUSTER
29	0010-00603-0000	EXTENSION SPRING (2 REQ'D.)
30	0017-00101-0665	#10-32 x 7/8 UNSLOT. HEX HD. WHZ. BOLT.
31	0017-00101-0656	#10-32 x 1/2 SLT. PAN HD. SCREW (2 REQ'D.)
	A639-00039-0000	ADJUSTMENT BRKT. ASSY. (ITEMS 27 THRU 31)

NO. 639 — KOZMIK KROOZ'R — ANALOG CONTROL ASSY.

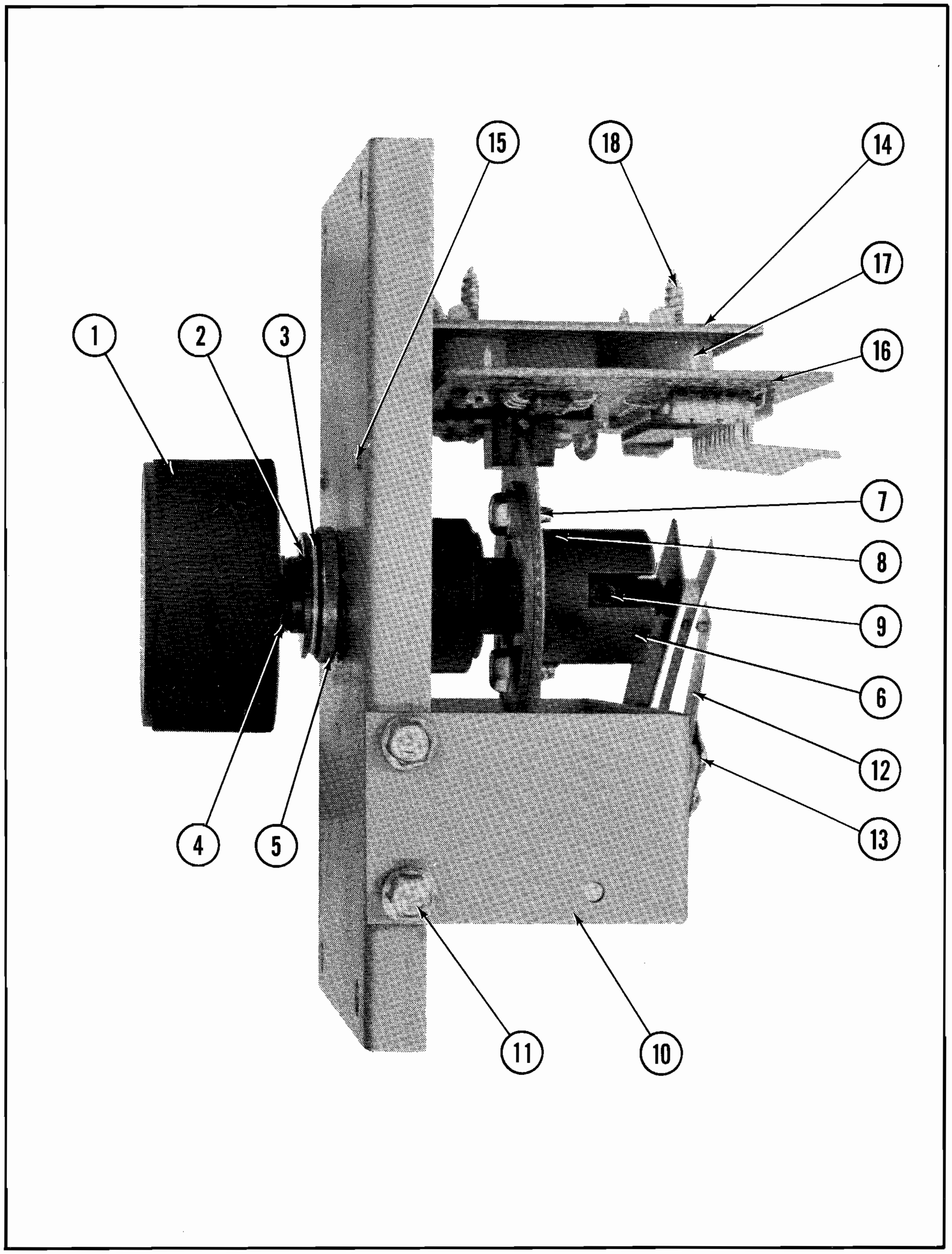


NO. 639 — KOZMIK KROOZ'R — ANALOG CONTROL ASSY. — PARTS LIST

ORDER BY PART NUMBER ***ONLY***

ITEM	PART NO.	DESCRIPTION
1	0873-00900-0400	CONTROL GRIP — LEFT
2	0873-00900-0300	CONTROL GRIP — RIGHT
3	0639-00926-0000	LENS
4	0628-00906-0000	TRIGGER
5	A628-00028-0000	LEAF SWITCH ASSY.
	0020-00202-0000	SWITCH PLATE
	0017-00101-0528	#5-40 x 3/4 PHIL. RND. HD. M.S. (2 REQ'D.)
	0873-00123-00XF	SWITCH MTG. BRKT.
	0017-00101-0083	#4-20 x 3/8 PHIL. PAN HD. SCR. (2 REQ'D.)
6	0017-00101-0149	#10-32 x 3/8 TORX TAMPER RESISTANT BUTTON HD. SCREW (5 REQ'D.)
7	A639-00025-0000	TUBING & PIVOT PIN — PINNING ASSY.
	0628-00921-0000	SLEEVE — NOT SEEN
8	0628-00904-0000	SLIDE
9	0873-00113-00XF	BUMPER MTG. BRKT.
10	0639-00903-0000	BUMPER — 8 POSITION
11	0017-00101-0615	#8-32 x 3/8 SLT. PAN HD. M.S. (4 REQ'D.)
12	A639-00020-0000	CENTERING BRKT. WELD ASSY.
13	0628-00905-0000	GROMMET
14	0017-00104-0034	FLAT WASHER
15	0017-00103-0082	7/16-14 NYLON INSERT LOCKING NUT
16	0639-00700-00XF	ACTUATING PIN
17	0873-00706-00XF	PIVOT BUSHING
18	0017-00100-0015	5/32 E-RING
19	0017-00101-0799	#10-32 x 3/8 SLT. HEX HD. SCREW (4 REQ'D.)
20	0017-00103-0081	#10-32 HEX NUT W/SEMS (4 REQ'D.)
21	0017-00101-0598	#8-32 x 5/16 SLT. HEX HD. SCR. (10 REQ'D.)
22	0639-00108-0000	WEAR PLATE BRKT.
23	0639-00906-0000	WEAR PLATE
24	A639-00013-0000	SLIDE & MTG. BRKT. RIVET ASSY.
25	A084-91458-E000	ANALOG JOYSTICK P.C. BRD. ASSY.
26	A639-00014-0000	ACTUATING BRKT. ASSY. — UPPER
27	A639-00015-0000	ACTUATING BRKT. ASSY.
28	0069-264XX-XBYX	CORE (2 REQ'D.)
	0017-00103-0002	#4-40 HEX NUT (2 REQ'D.)
29	0010-00268-0000	EXTENSION SPRING (2 REQ'D.)
30	0639-00701-00XF	P.C. MTG. POST (4 REQ'D.)
31	0017-00101-0755	#6-32 x 5 SLT. PAN HD. M.S. (8 REQ'D.)
32	A089-00020-0000	CONTROL GRIP CABLE ASSY. — 16" LG.
	0010-00266-0100	SPRING EXTENSION STRAIN RELIEF
	0017-00021-0299	2 PIN CONNECTOR

NO. 639 — KOZMIK KROOZ'R — KNOB & SHAFT — ENCODER DISC ASSY.

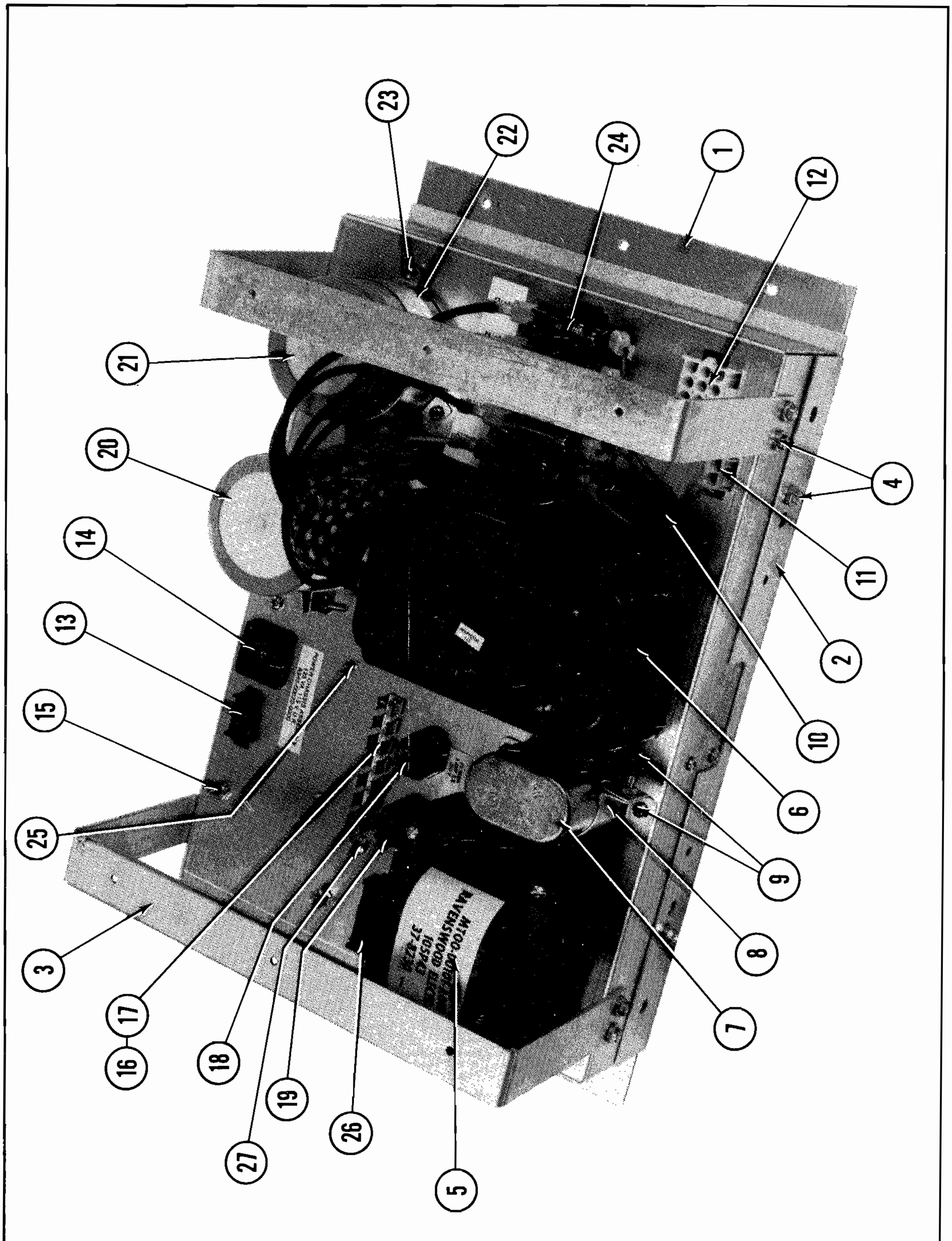


NO. 639 — KOZMIK KROOZ'R — KNOB & SHAFT — ENCODER DISC ASSY. — PARTS LIST

*ORDER BY PART NUMBER **ONLY***

ITEM	PART NO.	DESCRIPTION
1	A639-00034-0000	KNOB & SHAFT ASSY.
	0639-00925-0000	KNOB INSERT LABEL
2	0017-00100-0050	1/2" E-RING (2 REQ'D.)
3	0017-00104-0045	FLAT WASHER
4	0017-00104-0079	PLASTIC WASHER
5	A639-00035-0000	BEARING TO BUSHING ASSY.
6	0639-00704-00XF	MAIN SHAFT
7	A639-00048-0000	SENSOR DISC ASSY.
8	0017-00101-0791	#8-32 x 1/4 HEX CUP SET SCREW (2 REQ'D.)
9	0639-00705-00XF	STOP STUD
	0639-00911-0000	ROLLER SLEEVE
10	0639-00114-0000	SWITCH MTG. BRKT.
11	0017-00101-0124	#6 x 1/4 UNSLOT. HEX HD. M.S. (4 REQ'D.)
12	A639-00058-0000	LEAF SWITCH ASSY.
13	0020-00202-0000	SWITCH PLATE
	0017-00101-0527	#5-40 x 5/8 PHIL. RND. HD. SCR. (2 REQ'D.)
14	0531-00106-0000	P.C. MTG. BRKT.
15	0017-00101-0586	#8-32 x 3/16 SLT. PAN HD. M.S. (2 REQ'D.)
16	A084-91482-A000	OPTICAL ENCODER P.C. BRD. ASSY.
17	0017-00042-0072	PLASTIC GROMMET (4 REQ'D.)
18	0017-00101-0018	#6 x 3/4 SLT. HEX HD. WD. SCR. (4 REQ'D.)

KOZMIK KROOZ'R — POWER CHASSIS ASSY. — 125VA., 115V.

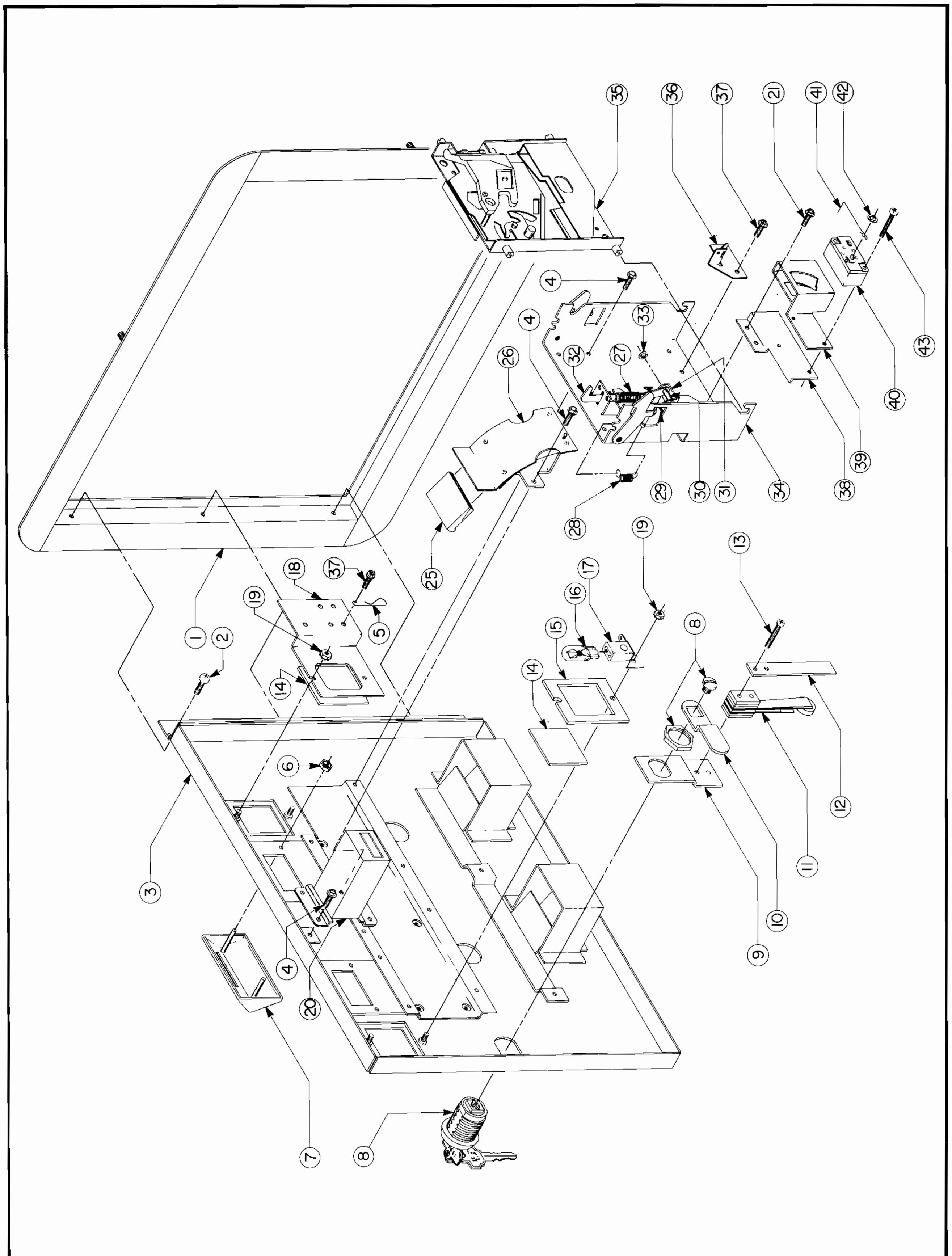


KOZMIK KROOZ'R — POWER CHASSIS ASSY. — 125 VA., 115V. — PARTS LIST

ORDER BY PART NUMBER ***ONLY***

ITEM	PART NO.	DESCRIPTION
1	0945-00104-00XF	CHASSIS
2	A945-00029-0000	MTG. PLATE & BARRIER ASSY.
3	0945-00107-01XF	STRAP (2 REQ'D.)
4	0017-00101-0123	#8 x 1/4 UNSLOT. HEX HD. SCR. (12 REQ'D.)
5	MT00-00101-A000	ISOLATION TRANSFORMER W/O SHIELD ASSY. — 115V., 50/60 HZ.
	0017-00103-0061	#8-32 HEX NUT W/SEMS (4 REQ'D.)
6	MT00-00099-A000	POWER TRANSFORMER ASSY. — 115V., 60 HZ.
	0017-00103-0084	#6-32 HEX NUT W/SEMS (4 REQ'D.)
7	0175-181T4-GXJK	CAPACITOR — 3.5 M.F., 440V.
8	0017-00009-0535	CLAMP
	0017-00101-0565	#6-32 x 7/16 SLT. PAN HD. SCR.
	0017-00103-0084	#6-32 HEX NUT W/SEMS
9	0017-00101-0067	#6 x 3/8 PHIL. PAN HD. SCR. (11 REQ'D.)
	0945-00103-00XF	PARTITION — LOCATED UNDER CHASSIS (NOT SEEN)
10	0945-00902-0000	SNAP BUSHING (3 REQ'D.)
11	0017-00021-0297	2 POSITION CONNECTOR
12	A945-00030-0100	CONNECTOR & CABLE ASSY. #1
13	A945-00030-0200	CONNECTOR & CABLE ASSY. #2
14	A945-00021-0000	CONVENIENCE OUTLET ASSY.
15	0017-00101-0573	#6-32 x 1/2 PHIL. RND. HD. SCR. (2 REQ'D.)
	0017-00103-0084	#6-32 HEX NUT W/SEMS (2 REQ'D.)
	A945-00025-0000	FILTER ASSEMBLY — 125V. — UNDER CHASSIS (NOT SEEN)
16	0017-00021-0510	TERMINAL STRIP
17	0017-00101-0140	#4-40 x 5/16 PHIL. PAN HD. SCR. (2 REQ'D.)
18	0017-00003-0263	SLO-BLO FUSE — 4A., 250V.
19	0017-00003-0005	FUSE — 2A., 250V.
	0017-00003-0444	QUICK CONN. FUSEHOLDER (2 REQ'D.) — FOR ABOVE FUSES
20	0945-00816-1902	CAPACITOR — 100,000 M.F.
21	0945-00816-1901	CAPACITOR — 55,000 M.F.
	0017-00104-0107	#10 FLAT WASHER (4 REQ'D.)
	0017-00103-0081	#10-32 HEX NUT W/SEMS (4 REQ'D.)
22	0017-00009-0422	CLAMP (2 REQ'D.)
	0017-00101-0758	#8-32 x 3/4 PHIL. RND. HD. SCREW (2 REQ'D.)
	0017-00103-0061	#8-32 HEX NUT W/SEMS (2 REQ'D.)
23	0017-00101-0067	#6 x 3/8 PHIL. PAN HD. SCR. (6 REQ'D.)
24	0945-00904-0000	5 POSITION FUSE HOLDER
	0017-00003-0263	SLO-BLO FUSE — 4A., 250V.
	0017-00003-0217	SLO-BLO FUSE — 2.5A., 250V. (2 REQ'D.)
	0017-00003-0007	SLO-BLO FUSE — 3A., 250V. (2 REQ'D.)
	0945-00903-0000	FUSE HOLDER BARRIER
	A945-00022-0000	HEATSINK & DIODE ASSY.
	0017-00101-0067	#6 x 3/8 PHIL. PAN HD. SCR. (2 REQ'D.)
25	0017-00101-0780	#6 x 1/2 PHIL. PAN HD. SCREW (2 REQ'D.)
	0017-00021-0629	5 POSITION TERMINAL STRIP — (UNDER CHASSIS)
	A945-00019-0000	LINE CORD ASSY. — 115V. (NOT SHOWN)
26	A945-00030-0500	CONNECTOR & CABLE ASSY.
27	0017-00101-0660	#10-32 x 3/4 PAN HD. SCREW
	0017-00104-0107	#10 FLAT WASHER
	0017-00103-0081	#10-32 HEX NUT W/SEMS

FRONT DOOR ASSEMBLY — U.S.A. 25¢



FRONT DOOR ASSEMBLY — U.S.A. 25¢ — PARTS LIST

*ORDER BY PART NUMBER **ONLY***

ITEM	PART NO.	DESCRIPTION
1	0090-00002-04BK	DOUBLE ENTRY COIN DOOR FRAME
2	0017-00101-0121	#6-32 x 5/16 PHIL. TRS. HD. SCR. (3 REQ'D.)
3	A090-00073-02BK	DOUBLE ENTRY COIN DOOR W/DRESS PLATE
4	0017-00101-0123	#8 x 1/4 UNSLOT. HEX HD. SCREW (12 REQ'D.)
5	0017-00007-0019	KEY HOOK
6	0017-00103-0059	PUSH NUT (4 REQ'D.)
7	0090-00912-0000	COIN ENTRY PLATE — 25¢ (2 REQ'D.)
8	A097-00005-0000	DOOR LOCK & KEY W/SCREW & NUT (OR)
8	A097-00006-0000	DOOR LOCK & KEY W/SCREW & NUT
9	0090-00128-00XF	DOOR TILT SWITCH BRKT.
10	0017-00005-0225	DOOR CAM
11	A090-00095-0000	DOOR TILT SWITCH
12	0090-00126-03XF	SWITCH BACK-UP PLATE
13	0017-00101-0525	#5-40 x 9/16" PHIL. HD. M.S. (2 REQ'D.)
	A090-00096-0000	DOOR TILT SWITCH & BRKT. ASSY. (ITEMS 9 & 11 THRU 13)
14	0090-00903-9500	25¢ WINDOW (2 REQ'D.)
15	0090-00143-00XF	COIN PLEX RETAINER
16	0017-00003-0219	12 VOLT LAMP — G.E. #194 (2 REQ'D.)
17	0017-00031-0048	WEDGE SOCKET W/BRKT. (2 REQ'D.)
18	A090-00100-0000	BRKT. ASSY.
19	0017-00103-0084	#6-32 HEX NUT W/SEMS (4 REQ'D.)
20	A090-00089-0000	COIN METER W/DIODE
21	0017-00101-0124	#6 x 1/4 UNSLOT. HEX HD. SCR. (4 REQ'D.)
25	0090-00911-0000	INSULATOR (2 REQ'D.)
26	A090-00112-0000	COIN CHUTE & TOP ASSY. (2 REQ'D.)
27	0010-00134-0000	SPRING
28	0010-00181-0000	SPRING
29	0017-00007-0083	1/8 x 1-5/8 ROLL PIN
30	0090-00129-00XF	PIVOT POST
31	0090-00167-00XF	PIVOT LEVER
32	0090-00182-00XF	REJECT LEVER
33	0017-00100-0018	E-RING
	A090-00088-0000	REJECT LEVER ASSY. (2 REQ'D.) (ITEMS 30 THRU 33)
34	A090-00105-0000	COIN ACCEPTOR FRAME ASSY. (2 REQ'D.)
35	0017-00005-0003	COIN ACCEPTOR W/STRING CUTTER (2 REQ'D.) (OR)
35	0017-00005-0211	COIN ACCEPTOR W/ANTI STRING DEVICE (2 REQ'D.) (OR)
35	0017-00005-0214	COIN ACCEPTOR W/STRING CUTTER (2 REQ'D.)
36	A090-00064-0000	ANTI-PENNY DEVICE
37	0017-00101-0099	#6 x 1/4 SLT. HEX HD. M.S. (2 REQ'D.)
38	0090-00162-00XF	COIN SWITCH MTG. BRKT.
39	0017-00005-0203	COIN SWITCH CHUTE
40	0017-00005-0195	COIN SWITCH
41	0010-00599-0000	COIN SWITCH WIRE
42	0017-00007-0015	PUSH-ON RING
	A090-00059-0400	COIN SWITCH & WIRE ASSY. (ITEMS 40 THRU 42)
43	0017-00101-0147	#4-40 x 3/4 PHIL. PAN. HD. M.S. (2 REQ'D.)
	A090-00077-0000	COIN GUIDE & SWITCH ASSY. (ITEMS 38 THRU 43)

V Technical Troubleshooting

Introduction

The most common problems occur in harness components such as the coin acceptor, player controls, interconnecting wiring, etc. The TV monitor and PCB computer cause their share of problems too, but not as much as the harness and its component parts. TV monitor troubleshooting will not be covered here because it is covered in that section of this manual.

As you already know, the PCB computer is a complex device with a number of different circuits. Some circuits remain basically the same among games, but overall there are a great many differences between them. PCB troubleshooting procedures, therefore, can be lengthy and will differ greatly among games. However, some basic Z-80 CPU information is involved in this section.

General Suggestions

The first step in any troubleshooting procedure is correctly identifying the malfunction's symptoms. This includes not only the circuits or features malfunctioning, but also those still operational. A carefully trained eye will pick up other clues as well. For instance, a game in which the computer functions fail completely just after money was collected may have a quarter shorting the PCB traces. Often, an experienced troubleshooter will be able to spot the cause of the problem even before opening the cabinet.

After all the clues are carefully considered, the possible malfunctioning areas can be narrowed down to one or two good suspects. Those areas can be examined by a process of elimination until the cause of the malfunction is discovered.

Harness Component Troubleshooting

Typical problems falling in this category are coin and credit problems, power problems and failure of individual features.

NO GAME CREDIT

For example, your prospective player inserts his quarter and is not awarded a game. The first item to check is if the quarter is returned. If the quarter is returned, the malfunction most certainly lies in the coin acceptor itself. First, use a set of test coins (both old and new) to ascertain that the player's coin is not undersize or underweight. If your test coins are also returned, coin acceptor servicing is indicated. Generally, the cause of this particular problem is a maladjusted magnet gate. Normally, this will mean slightly closing the magnet gate a little by turning the adjusting screw out a bit (see section on coin acceptor for more details).

If the quarter is not returned and there is no game credit, the cause of the malfunction may be in one of several areas. First try operating the coin return button; if the coin is returned, the problem is most likely in the magnet gate. Enlarge the gap according to the coin acceptor service procedures. If this does not cure the problem, remove the coin acceptor, clean it and perform the major adjustment procedure.

If the trapped coin is not returned when the wiper lever is actuated, you may have an acceptor jammed by a slug, gummed up with beer, a jammed coin chute, or mechanical failure of the acceptor mechanism. In this case, first check for the slug that will generally be trapped against the magnet. If so, simply remove the slug and test the acceptor. If the chute is blocked, remove the acceptor and remove the jammed coins. If there is actual failure of the acceptor, remove the unit and repair as indicated in the coin acceptor service procedures.

If the coin is making its way through the acceptor (that is, falling into the coin box), yet there is still no game credit, you either have a mechanical failure of the coin switch or electrical failure of the coin and credit circuits. The first place to begin is by checking the coin switch. Most of these switches are the make/break variety of micro switch, which is checked by testing for continuity between the NO, NC, and C terminals. When not actuated, the NC and C terminals should be continuous and the NO terminal open. When operated, the NO and C terminals should close and the NC should be open. If the coin switch checks out, examine the connections to the terminals to make sure there is good contact. If necessary, use the continuity tester and check from the terminal lug on the switch to the associated PCB trace. This will tell you if there is a continuous line all the way to the credit circuit.

If the coin switch wires do not check out, the problem is in the computer — most likely in the coin and credit circuitry.

If you do get game credit when a coin is deposited, but the game will not start when the start switch is pressed, you may have a problem in the start switch, the interconnecting wiring or in the computer. First check the switch. If the switch is OK, proceed to check the wiring. Again, make sure you go from the terminal lug on the switch to the PCB trace. This way, you will check the terminal contact as well as PCB edge connector contact. If the wiring is continuous, proceed to check the PCB credit circuit. If not, check each section of the wiring, until the discontinuity is located. If the wiring is OK, the problem must lie in the computer.

Transformer and Line Voltage Problems

Your machine must have the correct line voltage to operate properly. If the line voltage drops too low, a circuit in the computer will disable game credit. The point at which the computer will fail to work will vary some from game to game, but no game will work on line voltage that drops below 105 VAC.

Low line voltage may have many causes. Line voltage normally fluctuates a certain amount during the day as the total usage varies. Peak usage times occur mainly at dawn or dusk, so if your machine's malfunction seems to be related to the time of day, this may be a factor. A large load connected to the same line as the game (such as a large air conditioner or other device with an exceptionally large motor) may drop the line voltage significantly when starting up. This drop can result in an intermittent credit problem. In addition, poor connections in the location wiring, plug, or line cord may also cause a significant drop in power. Cold solder joints in the game's harness, especially in areas like the transformer connections, interlock switch, or fuse block, may also produce the same results, although probably on a more permanent basis.

Sometimes location owners (especially in bars) replace light switches with dimmer rheostats, and the game is sometimes on the same line. Obviously, the voltage available to the game is going to drop dramatically when the dimmer is turned.

In any case, the way to check for correct line voltage is with your VOM. Set the VOM to 250 VAC and stick the probes in the wall receptacle. If it's OK here, check the transformer primary connections. If you do not get 117 VAC, examine the solder joints on the transformer, fuse block, and interlock switch. If you do get 117 VAC, the problem must be either in the transformer, harness connections, or in the PCB power supply.

If you suspect the transformer, check its secondaries with the VOM set to 50 VAC and correlate the readings with the legend on the side of the transformer. The transformer must also be correctly grounded, so check the ground potential as well, especially if there is a hum bar rolling up or down the TV screen.

HARNESS PROBLEMS

Other harness problems include blowing fuses and malfunctioning controls. The repeating blown-fuse problem can sometimes be quite exasperating to solve, for short circuits have the tendency to occur in areas almost impossible to find. First, try inserting a new fuse, as old fuses age and blow without cause. If the new one also blows, you definitely have a short.

The best way to approach this problem is by turning the power off and disconnecting devices that may be causing the problem, such as the TV, transformer, and PCB. Disconnect the devices by pulling off their connectors, but do not allow them to touch. If necessary, insulate them with small pieces of electrical tape. Then, connect your VOM across the terminals of the fuse block (all electrical power shut off), and set it to one of the resistance scales. This will save blowing a fuse each time you want to check the circuit.

If the VOM reveals that disconnecting the devices removed the short, reconnect the devices one by one until the short returns. The last device connected is the one that is at fault. If the VOM reads a short even after the devices are disconnected, the fault must lie in the harness itself, and only patient exploration will reveal its location. First, carefully examine all the wiring, looking for terminals that may be touching, metal objects such as coins shorting connections or burned insulation. If necessary, use the VOM to check each suspected wire.

MALFUNCTIONING CONTROLS

One of the most common problems here is a bad potentiometer. Typically, a bad pot will cause the image to jump as it reaches a certain point. The only cure for this one is to install a new pot.

If a feature that is operated by a switch (for example, joysticks, foot pedals, control panel buttons) does not operate at all, check the switch with a VOM or continuity tester to verify its operation. If the switch does not check out, replace it. If the switch is OK, you should suspect the input to the switch from the PCB. In this case, get out the harness and logic schematics and check to see what kind of input it is. In many cases, the input will be +5 VDC. If so, use the VOM to check its presence. Normally, the switch is used to pull a +5 VDC line LOW to GND or to pull a LOW line HIGH. If the PCB output is missing, check the wire length from the PCB. If you find the signal at the PCB trace, the wire length or connection is at fault. If not, begin exploring the PCB using the logic schematics.

A Glossary of Microprocessor Terms

MICROPROCESSOR — one or several microcircuits that perform the function of a computer's CPU. Sections of the circuit have arithmetic and comparative functions that perform computations and executive instructions.

CPU — central-processing unit. A computing system's "brain", whose arithmetic, control and logic elements direct functions and perform computations. The microprocessor section of a microcomputer is on one chip or several chips.

PROM — programmable read-only memory. User permanently sets binary on-off bits in each cell by selectively fusing or not fusing electrical links. Nonerasable. Used for low-volume applications.

EPROM — erasable, programmable, read-only memory. Can be erased by ultraviolet light bath, then reprogrammed. Frequently used during design and development to get programs debugged, then replaced by ROM for mass production.

ROM — read-only memory. The program, or binary on-off bit pattern, is set into ROM during manufacture, usually as part of the last metal layer put onto the chip. Nonerasable. Typical ROM's contain up to 16,000 bits of data to serve as the microprocessor's basic instructions.

RAM — random-access memory. Stores binary bits as electrical charges in transistor memory cells. Can be read or modified through the CPU. Stores input instructions and results. Erased when power is turned off.

LSI — large scale integration. Formation of hundreds or thousands of so-called gate circuits on semiconductor chips. Very large scale integration (VLS) involves microcircuits with the greatest component density.

MOS — metal-oxide semiconductor. A layered construction technique for integrated circuits that achieves high component densities. Variations in MOS chip structures create circuits with speed and low-power requirements, or other advantages (static will damage a MOS chip).

Introduction to the Z-80 CPU

The term "microcomputer" has been used to describe virtually every type of small computing device designed within the last few years. This term has been applied to everything from simple "microprogrammed" controllers constructed out of TTL MSI up to low end minicomputers with a portion of the CPU constructed out of TTL LSI "bit slices." However, the major impact of the LSI technology within the last few years has been with MOS LSI. With this technology, it is possible to fabricate complete and very powerful computer systems with only a few MOS LSI components.

The Zilog Z-80 family of components can be configured with any type of standard semiconductor memory to generate computer systems with an extremely wide range of capabilities. For example, as few as two LSI circuits and three standard TTL MSI packages can be combined to form a simple controller. With additional memory and I/O devices a computer can be constructed with capabilities that only a minicomputer could previously deliver.

New products using the MOS LSI microcomputer are being developed at an extraordinary rate. The Zilog Z-80 component set has been designed to fit into this market through the following factors:

1. The Z-80 is fully software compatible with the popular 8080A CPU.
2. Existing designs can be easily converted to include the Z-80.
3. The Z-80 component set is at present superior in both software and hardware capabilities to any other microcomputer system on the market today.
4. For increased throughput the Z80A operating at a 4 MHZ clock rate offers the user significant speed advantages.

Microcomputer systems are extremely simple to construct using Z-80 components. Any such system consists of three parts:

1. **CPU (Central Processing Unit)**
2. **Memory**
3. **Interface Circuits to peripheral devices**

The CPU is the heart of the system. Its function is to obtain instructions from the memory and perform the desired operations. The memory is used to contain instructions and in most cases data that is to be processed. For example, a typical instruction sequence may be to read data from a specific peripheral device, store it in a location in memory, check the parity and write it out to another peripheral device. Note that the Zilog component set includes the CPU and various general purpose I/O device controllers, while a wide range of memory devices may be used from any source. Thus, all required components can be connected together in a very simple manner with virtually no other external logic.

General Purpose Registers

There are two matched sets of general purpose registers, each set containing six 8-bit registers that may be used individually as 8-bit registers or as 16-bit register pairs by the programmer. One set is called BC, DE and HL while the complementary set is called BC', DE' and HL'. At any one time the programmer can select either set of registers to work with through a single exchange command for the entire set. In systems where fast interrupt response is required, one set of general purpose registers and an accumulator/flag register may be reserved for handling this very fast routine. Only a simple exchange command need be executed to go between the routines. This greatly reduces interrupt service time by eliminating the requirement for saving and retrieving register contents in the external stack during interrupt or subroutine processing. These general purpose registers are used for a wide range of applications by the programmer. They also simplify programming, especially in ROM based systems where little external read/write memory is available.

Arithmetic & Logic Unit (ALU)

The 8-bit arithmetic and logical instructions of the CPU are executed in the ALU. Internally the ALU communicates with the registers and the external data bus on the internal data bus. The type of functions performed by the ALU include:

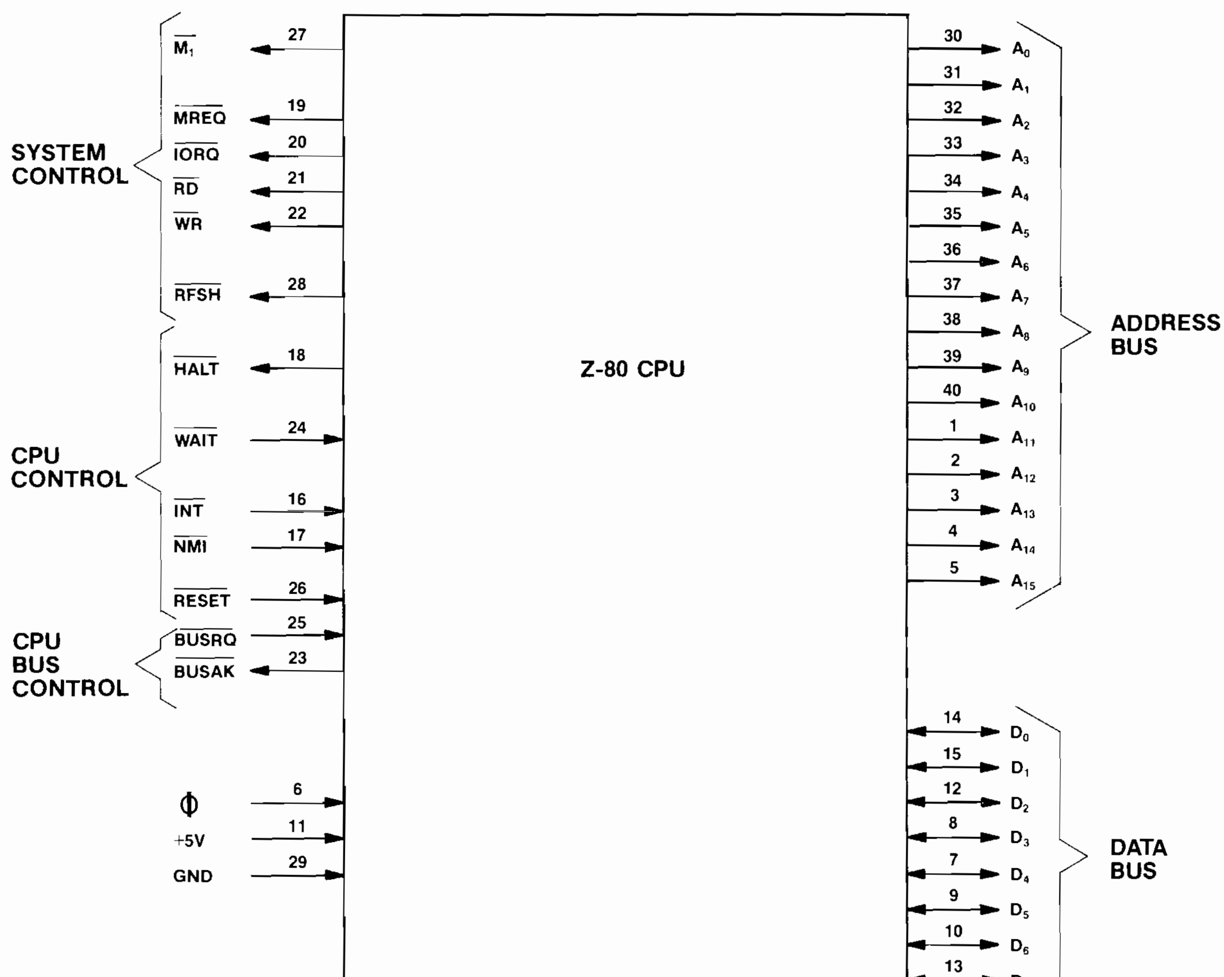
Add	Left or right shifts or rotates (arithmetic and logical)
Subtract	Increment
Logical AND	Decrement
Logical OR	Set bit
Logical Exlusive OR	Reset bit
Compare	Test bit

Instruction Register and CPU Control

As each instruction is fetched from memory, it is placed in the instruction register and decoded. The control sections performs this function and then generates and supplies all of the control signals necessary to read or write data from or to the registers, control the ALU and provide all required external control signals.

Z-80 CPU Pin Description

The Z-80 CPU is packaged in an industry standard 40 pin Dual In-Line Package. The I/O pins are shown in the below figure and the function of each is described.



Z-80 PIN CONFIGURATION

A_0-A_{15}
(Address Bus)
Tri-state output, active high. A_0-A_{15} constitute a 16-bit address bus. The address bus provides the address for memory (up to 64K bytes) data exchanges and for I/O device data exchanges. I/O addressing uses the 8 lower address bits to allow the user to directly select up to 256 input or 256 output ports. A_0 is the least significant address bit. During refresh time, the lower 7 bits contain a valid refresh address.

D_0-D_7
(Data Bus)
Tri-state input/output, active high. D_0-D_7 constitute an 8-bit bidirectional data bus. The data bus is used for data exchanges with memory and I/O devices.

M_1
(Machine Cycle one)
Output, active low. $\overline{M_1}$ indicates that the current machine cycle is the OP code fetch cycle of an instruction execution. Note that during execution of 2-byte op-codes, $\overline{M1}$ is generated as each op code byte is fetched. These two byte op-codes always begin with CBH, DDH, EDH or FDH. $\overline{M1}$ also occurs with $\overline{IORQ}$ to indicate an interrupt acknowledge cycle.

MREQ
(Memory Request)
Tri-state output, active low. The memory request signal indicates that the address bus holds a valid address for a memory read or memory write operation.

IORQ
(Input/Output Request)
Tri-state output, active low. The $\overline{IORQ}$ signal indicates that the lower half of the address bus holds a valid I/O address for a I/O read or write operation. An $\overline{IORQ}$ signal is also generated with an $\overline{M1}$ signal when an interrupt is being acknowledged to indicate that an interrupt response vector can be placed on the data bus. Interrupt Acknowledge operations occur during M_1 time while I/O operations never occur during M_1 time.

RD
(Memory Read)
Tri-state output, active low. $\overline{RD}$ indicates that the CPU wants to read data from memory or an I/O device. The addressed I/O device or memory should use this signal to gate data onto the CPU data bus.

WR
(Memory Write)
Tri-state output, active low. $\overline{WR}$ indicates that the CPU data bus holds valid data to be stored in the addressed memory or I/O device.

RFSH
(Refresh)
Output, active low. $\overline{RFSH}$ indicates that the lower 7 bits of the address bus contain a refresh address for dynamic memories and the current MREQ signal should be used to do a refresh read to all dynamic memories.

HALT
(Halt state)
Output, active low. $\overline{HALT}$ indicates that the CPU has executed a HALT software instruction and is awaiting either a non maskable or a maskable interrupt (with the mask enabled) before operation can resume. While halted, the CPU executes NOP's to maintain memory refresh activity.

WAIT
(Wait)
Input, active low. $\overline{WAIT}$ indicates to the Z-80 CPU that the addressed memory or I/O devices are not ready for a data transfer. The CPU continues to enter wait states for as long as this signal is active. This signal allows memory or I/O devices of any speed to be synchronized to the CPU.

INT
(Interrupt Request)
Input, active low. The Interrupt Request signal is generated by I/O devices. A request will be honored at the end of the current instruction if the internal software controlled interrupt enable flip-flop (IFF) is enabled and if the $\overline{BUSRQ}$ signal is not active. When the CPU accepts the interrupt, an acknowledge signal ($\overline{IORQ}$ during M_1 time) is sent out at the beginning of the next instruction cycle. The CPU can respond to an interrupt in three different modes that are described in detail in section 5.4 (CPU Control Instructions).

NMI
(Non-Maskable Interrupt)
Input, negative edge triggered. The non maskable interrupt request line has a higher priority than $\overline{INT}$ and is always recognized at the end of the current instruction, independent of the status of the interrupt enable flip-flop. $\overline{NMI}$ automatically forces the Z-80 CPU to restart to location 0066H. The program counter is automatically saved in the external stack so that the user can return to the program that was interrupted. Note that continuous $\overline{WAIT}$ cycles can prevent the current instruction from ending, and that a $\overline{BUSRQ}$ will override a $\overline{NMI}$.

RESET
Input, active low. RESET forces the program counter to zero and initializes the CPU. The CPU initialization includes:

1) Disable the interrupt enable flip-flop

2) Set Register I = 00H
3) Set Register R =00H
4) Set Interrupt Mode 0

During reset time, the address bus and data bus go to a high impedance state and all control ouput signals go to the inactive state.

BUSRQ
(Bus Request)
Input, active low. The bus request signal is used to request the CPU address bus, data bus and tri-state output control signals to go to a high impedance state so that other devices can control these buses. When BUSRQ is activated, the CPU will set these buses to a high impedance state as soon as the current CPU machine cycle is terminated.

BUSAK
(Bus Acknowledge)
Output, active low. Bus acknowledge is used to indicate to the requesting device that the CPU address bus, data bus and tri-state control bus signals have been set to their high impedance state and the external device can now control these signals.

CLK
(Clock)
Single phase TTL level clock which requires only a 330 ohm pull-up resistor to +5 volts to meet all clock requirements.

MCR II SYSTEM
P.C. BOARD JUMPER OPTIONS

VIDEO GENERATOR P.C. BOARD

MANUFACTURER	EPROM NO.	JW#1	JW#2	JW#3	JW#4	JW#5	JW#6	JW#7	JW#8
MOTOROLA	68764	#	*	*	#	*	*	*	*
	68766	#	*	*	#	*	*	*	*
INTEL	2764	*	#	#	*	#	*	*	#
T. I.	2564	#	*	*	#	*	#	#	*

SUPER C.P.U. P.C. BOARD

JUMPER OPTIONS FOR PROGRAM ROMS ONLY

MANUFACTURER	EPROM NO.	JW#2	JW#4	JW#5	JW#6	JW#7	JW#18	JW#19	
MOTOROLA	68764	#	#	*	#	*	*	#	
	68766	#	#	*	#	*	*	#	
T. I.	2564	#	#	*	#	*	*	#	
INTEL	2764	*	*	#	*	#	#	*	

JUMPER OPTIONS FOR BACKGROUND ROMS ONLY

MANUFACTURER	EPROM NO.	JW#10	JW#11	JW#12	JW#13	JW#14	JW#15	JW#16	JW#17
MOTOROLA	68764	*	#	*	#	*	#	#	*
	68766	*	#	*	#	*	#	#	*
T. I.	2564	*	#	*	#	*	#	#	*
INTEL	2764	#	*	#	*	#	*	*	#

SOUND I/O P. C. BOARD

MANUFACTURER	EPROM NO.	JW#1	JW#2
NUMEROUS MFR'S	2532	*	#
NUMEROUS MFR'S	2732	#	*

* = CUT JUMPER WIRES WHERE THIS SYMBOL "*" APPEARS.
= LEAVE JUMPER WIRES IN WHERE THIS SYMBOL "#" APPEARS.

The above table illustrates the fact that the Video Generator P.C. Board used in the MCR II System has 8 jumper wires, the SUPER C.P.U. P.C. Board used in the MCR II System has 19 jumper wires, and the Sound I/O P.C. Board used in the MCR II System has 2 jumper wires.

All of the above Boards can be used with a variety of different **SETS of EPROM chips.** However, these EPROMS are not all made by the same manufacturer and do have some internal differences. So, in order to make them function properly in their respective P.C. Boards, certain jumper wires on these Boards have to be cut.

The above table tells you which jumpers to cut (depending on which EPROM set you're going to use) by showing a "*" under that jumper wire's number. If there is **NO** "*" under a jumper wire's number, THAT PARTICULAR JUMPER WIRE **IS NOT TO BE CUT.**

PLEASE NOTE:

THE INFORMATION CONTAINED IN THIS SECTION IS TOLD IN AN EASY TO UNDERSTAND MANNER AND IS INTENDED TO AID THOSE WITHOUT AN ELECTRONICS DEGREE IN TROUBLESHOOTING AND REPAIRING THEIR GAMES T.V. MONITOR.

IF YOU READ THROUGH THIS SECTION AND STILL HAVE QUESTIONS, PLEASE CONTACT YOUR DISTRIBUTOR OR MIDWAY MANUFACTURING COMPANY AT THE TOLL FREE NUMBER PROVIDED WITH YOUR GAMES PAPERS.

OUR STAFF AND OUR DISTRIBUTORS STAND READY TO HELP YOU!

THANK YOU

VI. T.V. Monitor Manual

Introduction: (How to use this section of your manual.)

This section has been designed to simply familiarize you with one of the more mystical components in your game — the T.V. monitor. If you are an electronics technician who is quite knowledgeable on the subject, you may decide to just go to the schematics and start troubleshooting the defective monitor. But if you are like most people, a monitor is a T.V. set, and that means a complex doo-dad that means big buck repairs. This isn't necessarily so. This section of the manual will acquaint you with the monitor and could just help you repair it if you feel adventurous enough to give it a try. If you have any knowledge of electronics, especially the use of a voltmeter, the repairs you can make are astonishing. Just keep in mind that **ELECTRICITY CAN BE VERY DANGEROUS, SO BE CAREFUL!!**

If you want to understand how a monitor works, just read the "THEORY OF OPERATION" subsection. If you wish, you can follow along with the schematics. The information is presented in a very basic manner but a more complete treatment of the subject can be found in the technical sections of bookstores.

If you want to attempt to repair your monitor, it would be a good idea to read this whole section beginning to end before starting. **Pay attention to all warnings and take them seriously**. The more equipment you have the better, but a low cost Volt-Ohm-Milliameter can often do the trick. Here are the steps to take:

1. Find the symptom that matches the problems your monitor has in the "SYMPTOM — DIAGNOSIS" subsection. The diagnosis tells the circuit or area the problem may be in and possibly even the actual component causing it.
2. Once you have the circuit that is causing the trouble, read the "TROUBLESHOOTING" subsection to learn the procedure for finding the bad part.
3. Next, go to the schematic section and find the schematic that matches your monitor. It may be helpful to read the "DIFFERENCES BETWEEN MONITORS" subsection if you are unsure of which monitor you have. Use the schematic to see what parts are in the offending circuit.

That really is all there is to it. Just remember that there are some bizarre or rare symptoms not covered, or that a monitor may have two or more different problems that only a genius, the experienced, or an experienced genius can figure out. But be patient, follow safety precautions, and remember that there is also literature available from the monitor companies through your distributor or from Bally Midway Manufacturing Company on request. (There is a toll free number on the back side of the front cover of this manual.)

Symptom Diagnosis

1. **Insufficient width or heighth:**
   - A. Horizontal line (due to VERTICAL CIRCUIT DEFECT).
     - ☐ Bad yoke.
     - ☐ Bad vertical output section.
     - ☐ Open fusible resistor in vertical section.
     - ☐ Bad height control.
     - ☐ Bad flyback.
   - B. Vertical line (due to HORIZONTAL CIRCUIT DEFECT).
     - ☐ Bad yoke.
     - ☐ Open width coil.
     - ☐ Open part in horizontal output section.
2. **Picture spread out too far or crushed in certain areas:**
   - A. Horizontal or vertical output transistor.
   - B. Bad Component in output circuitry.
   - C. Vertical linearity or damper control needs adjustment.
3. **Line too close with black spacing:**
   - A. Problem in vertical section causing poor linearity.
4. **Poor focus and convergence:**
   - A. Bad high voltage transformer ("flyback") or control.
   - B. Focus voltage wire not connected to neck-board terminal.
5. **Colors missing; check:**
   - A. Interface color transistors.
   - B. Color output transistors.
   - C. Cracked printed circuit board (neck Board).
   - D. Color circuits.
   - E. Video input jack.
   - F. Defective picture tube.
6. **Picture not bright enough:**
   - A. Weak emission from picture tube.
7. **Silvery effect in white areas; check:**
   - A. Beam current transistors.
   - B. Weak picture tube emission.
8. **Too much brightness with retrace lines; check:**
   - A. Beam limiter transistors.
   - B. Brightness and/or color blanking control set too high.
9. **Increasing brightness causes an increase in size and poor focus.**
   - A. Weak high voltage rectifier or regulation (high voltage unit).
   - B. Bad component in monitor's power supply.
10. **Small picture and/or poor focus:**
    - A. Low B+ voltage (power supply trouble).
11. **Vertical rolling:**
    - A. Vertical oscillator in the IC, vertical sync. transistor, or circuit.
    - B. No sync from logic board.
    - C. Three pin sync. jack is loose or plugged in wrong.
12. **Horizontal line across center:**
    - A. Vertical output circuit is dead (see symptom No. 1. A.).
    - B. Vertical oscillator is not putting out the right wave form.
13. **Picture bends:**
    - A. Horizontal sync needs adjusting.
    - B. Magnetic or electromagnetic interference.
14. **Flashing picture, visable retrace lines:**
    - A. Broken neck board.
    - B. Internal short circuit in the picture tube (arcing).
15. **Unsymmetrical picture or sides of picture:**
    - A. Defective yoke.
16. **No brightness, power supply operating — No high voltage for the picture tube; check:**
    - A. Horizontal oscillator.
    - B. Horizontal amplifier and output.
    - C. Flyback transformer (high voltage unit).
17. **No brightness, high voltage present; check:**
    - A. Heater voltage to the tube at the neck board.
    - B. Screen-grid voltage for the tube.
    - C. Focus voltage.
    - D. Grid to cathode picture tube bias.
18. **No high voltage; check:**
    - A. For AC input to the "flyback".
    - B. Horizontal deflection stages.
    - C. Flyback transformer.
    - D. Yoke.
    - E. Power supply.
19. **No horizontal and vertical hold; check:**
    - A. Sync transistors and circuit.
    - B. Wires and jack from logic board to the monitor.
20. **Wavey picture — (power supply defect); check:**
    - A. Transistors, diodes, electrolytic capacitors in the power supply.

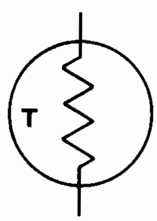
21. **Moving bars in picture:**
   A. Ground connector off between monitor and logic boards.
   B. Defect in the power supply (see wavy picture symptom).

22. **Washed out picture (see picture not bright enough):**
   A. Check video signal at the cathode pins with an oscilloscope. If there is about 80 volts peak to peak, the picture tube has weak emission.

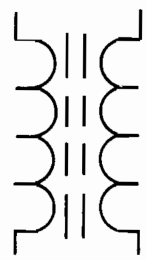
23. **Monitor won't turn on:**
   A. Problem in the power supply: Check fuse, transistors, open fusible resistor.
   B. Shorted horizontal output transistor.
   C. Defective high voltage disabling circuit.
   D. Crack(s) somewhere on main chassis board.

24. **Can't adjust purity or convergence:**
   A. Use a degausser to demagnetize the picture tube carefully following your degausser's instructions.
   B. Picture tube defective.
   C. Nearby equipment is electromagnetically interferring.
   D. The poles of the earth are pulling off the purity — see "A" above.
   E. Poor focus or width of picture.
   F. Make sure you have the correct CRT number for that brand of monitor.

Guide To Schematic Symbols



THERMISTOR
(POLARITY DOESN'T MATTER)



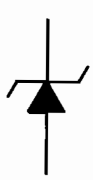
IRON CORE TRANSFORMER
(SUCH AS A FLYBACK)



INDUCTOR, COIL, CHOKE
(POLARITY DOESN'T MATTER)



FUSE
(POLARITY DOESN'T MATTER)



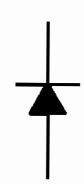
(-) CATHODE

(+) ANODE

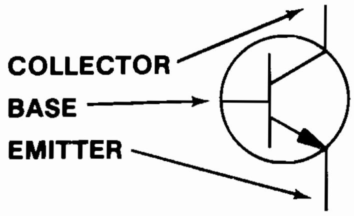
ZENER DIODE

CATHODE (-)

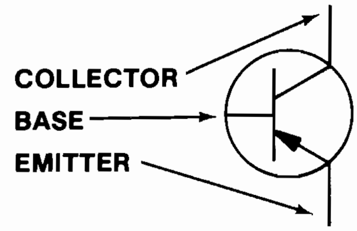
ANODE (+)



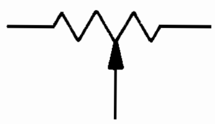
DIODE



NPN TRANSISTOR



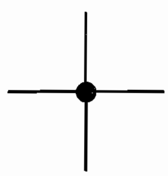
PNP TRANSISTOR



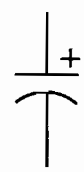
VARIABLE RESISTOR, POT, CONTROL
(POLARITY DOESN'T MATTER)



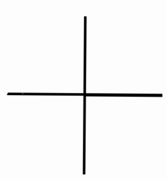
RESISTOR
(POLARITY DOESN'T MATTER)



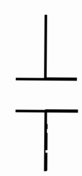
LINES ARE CONNECTED



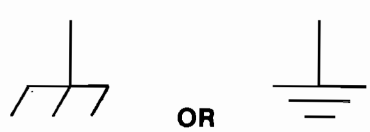
ELECTROLYTIC CAPACITOR



LINES ARE NOT CONNECTED



CAPACITOR
(POLARITY DOESN'T MATTER)



GROUND

Troubleshooting

Troubleshooting monitors requires experience, patience, **and luck**. The first step is to match the symptom the monitor displays to the diagnosis next to it in the "SYMPTOM-DIAGNOSIS" subsection. This will pinpoint the circuit the problem is probably in, and often the parts to check. Next, the circuit should be visually inspected to see if there are any parts broken, burned, or if something is there that shouldn't be, like a loose screw, etc. Some parts go bad before others and should be checked first. In fact, following is the general order in which parts usually go bad:

1. Semiconductors (like transistors, diodes, and integrated circuits).
2. Fusible resistors.
3. Electrolytic capacitors.
4. Resistors.
5. Capacitors and coils.

Always remember that a monitor can bite like a snake. Even when it is turned off, capacitors hold voltage and will discharge it to you should you be touching chassis ground. The picture tube or CRT, itself, is a giant capacitor, so avoid the flyback anode plug hole. With the monitor on, the power supply circuit and/or the flyback, which puts out at least 23,000 volts, **CAN BE KILLERS!!** Avoid handling power transistors (usually output transistors) or ICs, yoke terminals, and other high power components when the monitor is on.

WARNING: That picture tube is a bomb!
When it breaks, first it implodes, then it explodes. Large pieces of glass have been known to fly in excess of 20 feet in all directions. **DO NOT** carry it by the long, thin neck. Discharge its voltage to ground by shorting the anode hole to ground. Use a plastic handled screwdriver, connect one end of a wire with an alligator clip at each end to chassis ground and the other end to the metal shaft of the screwdriver. Using ONE HAND ONLY (put the other in your pocket) and touching ONLY the plastic handle of the screwdriver **(DO NOT TOUCH THE METAL SHAFT)** stick the blade of the screwdriver into the anode hole.

IMPORTANT! The side brackets of the monitor are chassis ground as is the aquadag, the picture tube's dark conductive coating. **BUT,** on the ZENITH MONITOR there are metalic mounting parts which **ARE NOT** chassis ground. Discharging the CRT to these will damage the monitor!

Be prepared for a fairly loud pop and a flash. The longer the monitor has been turned off, the smaller the pop and dimmer the flash. But **BE CAREFUL,** picture tubes will hold a very healthy charge for at least **a week** if not longer. Even after you've discharged it once, it may still carry a residual charge. It's better to be too careful than dead, which is why electronic equipment always carries stickers referring servicing to qualified personnel. Handle the side with the viewing screen against your chest when changing it. **ALWAYS** wear safety goggles when handling the picture tube.

To maintain the safety and performance of the monitor, always use exact replacement parts. For instance, the wrong components in the power supply can cause a fire, or the wrong color transistor may give a funny color to the picture. Service your monitor on a nonconductive firm table like wood, **NOT METAL,** and take off all of your jewelry just in case. With all this in mind, you are ready to begin troubleshooting.

Observe the picture carefully. Try to vary the appropriate control that would most likely affect your particular symptom. For example, if there is poor brightness or no picture, try turning up the brightness or contrast control. If the controls have no effect at all, chances are there is trouble with the control itself, the circuit it controls, or a nearby circuit that may be upsetting voltages. Go to the list of symptoms and determine with the schematic where the bad circuit is.

CAUTION:

Keep in mind that capacitors hold a charge as can the picture tube (for at least a week and usually longer), and could shock you.

First, check for obvious visual defects such as broken or frayed wires, solder where it is not supposed to be, missing components, burned components, or cracked printed circuit boards. If everything looks good up to this point, make sure that diodes, electrolytic capacitors, and transistors have their leads connected in the right polarity as shown on the schematic and the circuit board.

Turn on the power and measure the voltages at the leads of the active devices such as tubes, transistors, or integrated circuits. Any voltage that does not come within at least 10% to 15% of the voltage specified on the schematic indicates either a problem with that device or a component connected with it in the circuit. The next step is to use the ohmmeter to narrow down the field of possible offenders.

To test a transistor, one lead of the ohmmeter is placed on the base; and the other lead placed just on the emitter, then on the collector. A normal transistor will read either high resistance (infinite), or little resistance (400 to 900 ohms), depending on the polarity of this type transistor. Then the leads should be switched, one remaining on the base, and the other switched from the emitter to the collector. Now the opposite condition should result: the resistance should be infinite if it was lower when the other lead was on the base. Consistantly infinite readings indicate an open, and a short is demonstrated by 0-30 ohms on most of these test readings. Finally, place one lead on the collector, then the other on the emitter. No matter which lead is used, there should be infinite resistance. Any lower reading, such as 50 ohms (which is typical on a bad transistor), indicates a short.

This all sounds pretty confusing, but a little experience on a good transistor will make you an expert in no time. Usually, the lowest ohmmeter setting is used for testing transistors. Once in a great while a transistor may check out good on this test, but may actually be "leaky" or break down only on higher voltages. If in doubt, change it. It is also wise to check the transistor out of the circuit just in case some component in the circuit is affecting the ohmmeter reading.

A diode is tested like a transistor except it only has two leads. Again, there should be high resistance one way and little resistance the other. If it tests bad, take one lead out of the circuit in case some component is messing up the ohmmeter reading.

NOTE: **DO NOT** leave soldering equipment on the leads too long since all semiconductors, especially integrated circuits, are easily destroyed by heat.

Without special equipment, integrated circuits are checked by verifying the proper DC voltage on the pins and the correct AC wave form using an oscilliscope. **BE CAREFUL:** Shorting their pins can easily destroy them.

Resistors are checked with an ohmeter and should usually be within ten percent of the value stated on them and on the schematic. You may have to desolder one lead from the printed circuit board. If you wreck the foil on the board, carefully solder a small wire over the break to reconnect the conductive foil.

Capacitors are tricky. Their resistance goes up when checked with an ohmmeter which shows a charging action. As they suck up current from the meter, the voltage goes up and so does the resistance. If you are sure a particular circuit is giving you a problem and everything else checks out O.K., Electrolytic capacitors are prime suspects. Substitute a new one and keep your fingers crossed.

Theory of Operation

To understand what goes on inside the monitor, large general groups of circuits will be examined instead of laboriously analyzing the branches and small circuits that make up these groups. This will help avoid confusion and aid in a basic, concrete, knowledge of what makes up a monitor.

THE POWER SUPPLY —

The AC going to the monitor from the game transformer is just like the voltage and current from your wall outlet. It jumps up and down going positive and negative sixty times a second. But a monitor needs nice, smooth DC; direct current, not alternating. So diodes chop up the AC and a big electrolytic capacitor filters it out to make it even smoother. Since the monitor is a big piece of electronic equipment, with many circuits demanding a lot of power from the power supply, there are also zener diodes and transistors to help maintain a nice, constant, smooth voltage so that the monitor circuits don't jump around. And this is what happens when you see a wavy picture. There is AC creeping through the power supply, so it must be malfunctioning. If the voltage from the power supply is too low, the other circuits will be starved for power and you may see a small, wavy picture, or none at all.

Some circuits receive voltages that are higher than what the power supply should put out. But they come from the flyback transformer which will be discussed later.

THE INTERFACE SECTION OF THE CHASSIS —

The interface section of the chassis is fairly easy to identify. It is right by the place where the video jack(s) from the logic board(s) plug into. There are sets of transistors that receive the separate red, green, blue, and sync information from the cables that come from the logic boards. The circuits jack up the voltage and match impedances, or in other words, prepare the logic board outputs for the circuits that will really amplify them for the output devices such as the yoke in the case of the sync, or the picture tube that shows the colors.

An interesting aside is that our sync is composite negative sync. That means two things:

1. The sync is a negative going wave form.
2. There are two pulses going at different speeds over the same wire:
   a. Vertical wave forms at 60 times per second (or Hertz) and
   b. Horizontal wave forms at about 15,750 times per second (Hz).

The sync is amplified by a sync amplifier transistor and sent on its way to the oscillators. The sync or timing information will be explained along with the oscillator shortly.

The color information is sent via wires to the neck board where the main amplification occurs. This will also be discussed later.

VERTICAL AND HORIZONTAL DEFLECTION—

After the sync signal is amplified by the sync amp, it goes to two different sections, the vertical and horizontal circuits. Basically, the sync signals are for timing so the picture doesn't mess up since it is assembled like an orderly jigsaw puzzle, but so fast that you can't see the electron beams for each color painting the picture on the screen. This will all become clear soon. For now, we will follow the 60 cycle component of the sync as it goes on its journey to the deflection yoke.

The 60 cycle pulse goes to the vertical oscillator to make sure this circuit goes back and forth (or oscillates) at 60 times a second. Without this pulse keeping the circuit at the correct speed, it may get lazy and oscillate at 58 cycles or lower, or get ambitious and oscillate at 62 cycles or higher. At the wrong speed, the picture will start to roll up or down.

A Wells Gardner 13" (K4806) or 19" (K4906, K4956) color monitor uses an integrated circuit for its sync section. An Electrohome 13" or 19" color monitor uses an integrated circuit IC501 for its sync section. The Zenith monitor (CD19MXRF06) also uses an IC for the sync processing. Wells Gardner uses HA11423, Electrohome uses HA11244, and Zenith uses 221-175 (their part number). **These ARE NOT interchangeable!** The idea is all the same. The output to the vertical amplifying transistors for all monitors must form a sawtooth wave form, sort of like a bunch of pyramids, racing through the yoke's vertical coils at 60 times a second.

Along the way to the output transistors, the 60 cycle pulse is shaped and amplified to do the job: the yoke magnetically pushes the electron beam to fill the screen out sideways looking at the screen with the greatest length going up and down. Or viewing the screen sitting like a home television set, the amplified vertical output fills the screen up and down. Watching a monitor like this, seeing only a horizontal line means a problem with the vertical coils of the yoke or anything from the vertical output section on back to the oscillator.

The horizontal section is very similar with a few exceptions. The horizontal wave shape is more like a square and has a frequency of 15,750 cycles a second. Both Wells Gardner and Electrohome use the other side of their respective integrated circuits for the horizontal circuitry. If the oscillator isn't going at the correct speed, the picture may move sideways, start to slant, or tear up with slanted thin figures. With both the vertical and horizontal of all monitors, there are variable resistors that change the speed of the oscillators up and down. This way you have controls that can make the correct frequencies to keep the electronic jigsaw puzzle nicely locked in place. If you're driving in a car and next to you someone else is driving their car at exactly the same speed, it will appear that they are not moving. And this is why the sync frequency and the oscillator's frequency must match, so the picture doesn't appear to move.

The correct wave form is shaped and amplified in the circuitry just like in the vertical section. But the horizontal output transistor is a large power transistor and not only serves to give current to the horizontal yoke windings, it also feeds the flyback transformer.

THE FLYBACK TRANSFORMER (OR HIGH VOLTAGE UNIT) —

The picture tube needs high voltage to light up, and the power supply can't meet this demand. The flyback transformer receives current alternating at about 15,750 times per second from the horizontal output transistor. The "flyback" jacks up its input voltage and puts out a higher voltage alternating at the same speed. But, in your "flyback" there are diodes that chop up the alternating voltage to make it a smooth DC output just like in the power supply. This is what goes through that thick red wire to your picture tube. THIS AREA HAS ABOUT 24,000 VOLTS ON IT **AND IT CAN KILL YOU!!**

The "flyback" may be dangerous, but it is also generous. It has extra output windings which give voltage to the heater pins of the picture tube, voltage for the vertical deflection circuits, and picture tube screen-grid voltage. So in a way, the high voltage "flyback" is like a second power supply.

COLOR CIRCUITS —

The color circuits are pretty straight forward. The signals go into the interface section where some amplification and impedance matching occurs. These circuits are pretty sparse and simple. Each color just has two transistors and a diode with some resistors and capacitors. From here, the AC color signal is sent by wires to the neck board.

The color output circuits are on the neck board. The color signals going to the transistors are controlled by two variable resistors called drive controls. There are only two, one for the red and one for the green on

Wells Gardner and Electrohome monitors. Zenith monitors have all three: red, blue and green.

The Wells Gardner and Electrohome monitor have another variable resistor in their emitter part of their color output transistors. These "cutoff controls" vary the amount of A.C. signal that the transistor amplifies and sends to the cathodes of the picture tube. The Zenith monitor has its cutoff controls in the interface section to vary the amount of signal going to the output transistors. The more signal, the more color.

If you think this is confusing, here is another little hitch. The Electrohome and Zenith monitors both have the actual A.C. picture information signal going through the emitters of the color output transistors. The Wells Gardner has the A.C. signal going to the base of the transistors. The blanking and beam limiting signals which come from the blanking and beam limiting transistors in the interface section go into the color output transistor base in the Electrohome and Zenith monitors, but enters into the emitter of the Wells Gardner monitor's color output transistor. Should you feel adventurous enough to look at this signal on an oscilloscope, it should look like a square.

The beam limiter helps control the brightness level, and the blanking transistor rapidly turns the picture tube on and off so that retrace lines don't show up on the screen. By turning up the brightness on a good monitor, these four to six retrace lines can be seen slanting diagonally across the picture.

PROTECTION CIRCUIT —

To protect the high voltage section against voltages that are too high coming from the power supply which could cause X-rays to be emitted from the "flyback", a circuit senses the higher power supply voltage and turns off the horizontal oscillator. Since the horizontal oscillator doesn't work, the horizontal output transistor has nothing to feed the "flyback" which in turn has nothing to feed the picture tube. The monitor will be silent, have no picture, and will appear to be off. **But don't be fooled.** There is still that excessive amount of voltage coming from the power supply. To find out, check at pin two of Wells Gardner's IC501 and emitter of X04 for the Electrohome monitor. Check the 95 volt test point (located near the "flyback") for the Zenith monitor. The Wells Gardner monitor doesn't use this circuit, but an open in the horizontal section could cause the monitor to appear off, yet still have power supply voltage flying around. Here are the voltages you should receive:

Wells Gardner	=	130VDC
Electrohome	=	120VDC
Zenith	=	95VDC

The best place to measure this voltage on an Electrohome monitor is at a pin marked B1 on the chassis. This is because a 13 inch color Electrohome monitor, The G07-FB0 or G07-902, has an integrated circuit and very little else in the power supply. Still, there should be 120VDC at B1.

THE PICTURE TUBE (OR CRT) —

ATTENTION! For information on picture tube replacement types, go to the last section, "PICTURE TUBE INTERCHANGEABILITY".

The picture tube or CRT is an output device. In other words, the end result of the circuit's work is displayed by this part. Actually, the output of other circuits is in the neck of the picture tube.

First, there is the heater. The heater boils off electrons from the cathodes so that they (the electrons) shoot up to the screen to excite the phosphors so that the three phosphors emit three colors of light.

The cathodes are next, and again they emit electrons to turn on the tube phosphors, making it glow. A defective cathode may cause the particular color it handles to be missing.

Next come the grids. The first grid is grounded. The following grid is the screen grid which receives about 300VDC depending on the brightness setting. The next grid closest to the picture tube screen is the focus grid which gets about one fifth the amount of voltage that is applied to the picture tube anode.

After jetting from the cathode through all these grids, the electrons speed through a mask, a sheet of material with tiny holes, and then excite the tiny dots of phosphor in the inside surface of the picture tube screen. The green electron gun (or cathode and circuitry) spits out electrons which head for the green phosphors only. The same goes for the red and blue guns. The way the phosphor light blends determines the color seen. Should these electron beams become too intense, they may burn the phosphor. With the monitor off, this can be seen as a dark permanent image of the video information on the tube screen.

Differences Between Monitors

The easiest way to identify the brand of monitor you are working with is to find the manufacturer's name or model number printed on the chassis or chassis base. But what if the monitor was in a Texas dust storm or buried in volcanic ash and this information is no longer there? Fear not! Each monitor has its own peculiarities and the following should help to identify them:

The **ELECTROHOME** G07-904 (19") and G07-902 (13") have their horizontal and vertical processing IC hidden under a silver can. A shiny metal top behind the "VERTICAL HEIGHT" and "HORIZONTAL FREQUENCY" control prove this is an Electrohome monitor.

The **WELLS GARDNER** K4906 (19") and K4806 (13") have their horizontal and vertical processing IC out in the open directly behind the "VERTICAL HOLD" control.

The **ZENITH** C019MXRF06 (19") monitor has its horizontal and vertical processing IC way in back by the picture tube. The monitor also has large white cables going from the main board to the neck board.

K4906 (1st TYPE) — This monitor's identifying tags have **BLACK** ink printed on a white background. There is **NO** Vertical Damping Control. (This Control would be next to the Vertical Hold Control but this area is jumpered with a small wire instead.

K4906 (2nd TYPE) — This monitor's identifying tags have **RED** ink printed on a white background. There **IS** a Vertical Damping Control next to the Vertical Hold Control. The Damping Control provides a few more lines on the top of the monitor screen (monitor viewed as a normal T.V. would be) for any video game that may need these lines to fit the picture on the screen. Moving the Control may distort the top part of your picture (or the side, depending on the game and how the monitor is mounted) so go ahead and move it if you are having this type of problem. To accommodate this new feature, there are a few circuit changes.

ONE MAJOR DIFFERENCE BETWEEN THESE TWO VERSIONS OF THE K4906 IS THE YOKE. They look the same but notice the part numbers:

K4906 **WITHOUT** the Damper Control: 2021111201

K4906 **WITH** the Damper Control: 2021111258

Since the companies like to change part numbers at the drop of a hat, the best thing to do is to request whatever part number is written on your yoke. If you should get the wrong yoke, the results will be:

Picture distortion.

Excessive brightness.

Too much or too little vertical picture size.

CONTROLS YOU MAY NOT TOUCH

Basically, on the Electrohome monitor, you can move any control you want **EXCEPT** for the B1 control. This sets the power supply voltage (ideally at 120 VDC) and is located right behind VERTICAL HOLD. The 13" Electrohome **DOES NOT** have this control. It may also be wise not to move the VERTICAL LINEARITY since this distorts the picture and is hard to reset perfectly. If you do move it, turn on the Cross Hatch Test Pattern of your game and try to get the squares to the point where they are equal in size by readjusting this Linearity Control.

On the Wells Gardner monitor, brightness is adjusted by the "BLACK LEVEL" Control which is right next to the Horizontal Frequency Control. Under the Focus Control is the "SCREEN" Control which you **DO NOT** touch. Yes, this control does adjust the brightness, but it is used to set the CRT bias and is adjusted at the factory. When Wells Gardner sets it, they mark the position with a black mark on the knob. If you move it, be sure to realign the mark and THEN set the BLACK LEVEL Control to the brightness you desire. So, other than the SCREEN control, you may adjust any of the controls.

The Zenith monitor has a 95 volt adjustment control. It is green and located behind the jack labeled 3D3. To discourage you from moving it, Zenith has placed a little glue on top of this control.

Parts Interchangeability

Some parts can be interchanged on all of the monitors. Here are the rules:

1. You **CAN** swap any resistor between monitors that has the same resistance, wattage rating, and tolerance.
2. You **CAN** swap any capacitor between monitors that has the same capacitance and voltage rating.
3. You **CAN** swap many of the parts between the 19" and the 13" versions of each manufacturer's monitor. **BUT,** be certain to compare the manufacturers' part numbers to be positive the parts you want to interchange are identical. **BE SURE** you have read the section DIFFERENCES BETWEEN MONITORS which was covered earlier.
4. You **MAY BE ABLE** to swap picture tubes between monitors. In the past you could swap any picture tube, but due to rampant engineering changes and new monitor models being introduced, you would need a computer to keep track of what could be swapped. For more information on this subject, go to "PICTURE TUBE INTERCHANGEABILITY".
5. You **CANNOT** change any part that is a **safety part,** one that is shaded in gray on the schematic; it **MUST** be **IDENTICAL** to the original. **To do otherwise IS DANGEROUS.** For instance, the 13 inch Electrohome (G07-902) monitor "flyback" looks identical to the 19 inch Electrohome (G07-904) monitor "flyback". In fact, there is even a 19 inch Electrohome (G07-905) monitor (which is an obsolete model) with a similar looking "flyback". **NONE OF THESE ARE INTERCHANGEABLE!!**
6. You **CAN** change any of the parts between the G07-904 and G07-907. They're essentially the same monitor except that the G07-907 has a vertically mounted picture tube.

If there is any doubt about what parts can be swapped between each manufacturer's 19 inch and 13 inch models, compare the manufacturer's part number between each one. If they match up, they are the same part.

Picture Tube Interchangeability

13" MONITORS

There are currently two 13" monitors being used: the Wells Gardner K4806 and the Electrohome G07-902. The picture tubes used are NOT interchangeable. The pins on the neck of the CRT will not fit in the socket should you use the wrong CRT.

Here is a chart for all the 13" color monitors Bally Midway uses.

ELECTROHOME	G07-902	— 370ESB22
WELLS GARDNER	K4806	— 370KSB22

19" MONITORS

Here it gets a little tricky. All of the picture tubes will fit no matter which is used. But if you use the wrong one, you will have problems with purity and/or dynamic convergence.

Purity trouble means that the color won't be true. If you turn up the color control for one color, instead of seeing that solid color it will show blotches or blobs of other colors on the screen.

Trouble with dynamic convergence means that there will be color fringing around solid lines at the edges of the screen.

The only way to ensure that you avoid these problems is to get the right picture tube or the right substitute.

Here is a list of the 19" monitors and the **CORRECT** CRT numbers.

ALL ELECTROHOME G07-904 —
- 19VMNP22 RCA
- 19VMJP22 RAULAND
- 510UJB22 HITACHI

WELLS GARDNER K4906 —
- 19VLTP22 RCA
- 19VMLP22 ZENITH
- 19VMKP22 PHILLIPS

ZENITH CD19MXRF06 —
- 19VMLP22 ZENITH
- 19VLTP22 RCA
- 19VMKP22 PHILLIPS

The factory recommended CRT type could change in the future for one reason or another, but the listed picture tubes will work. As a matter of fact, you can call another picture tube company to see if they have a replacement number to recommend...but caveat emptor — let the buyer beware.

Notes

19" COLOR MONITOR SCHEMATIC DIAGRAM
MODELS 19K4901, 19K4906, 19K4951, 19K4956

Power Supply Voltage and Symbols

Symbol	Voltage	Operating Circuit
■ (in circle)	15V	Vert. Osc. Sync Blanking CRT Cut-Off
⊗ (filled)	130V	Horiz. Osc. Horz. Drive Horz. Output Vert. Output
⊙	175V	Video Output

★

SERVICE TECHNICIAN WARNING
X-RAY RADIATION PRECAUTION:

THIS PRODUCT CONTAINS CRITICAL ELECTRICAL AND MECHANICAL PARTS ESSENTIAL FOR X-RAY RADIATION PROTECTION.
FOR REPLACEMENT PURPOSES, USE ONLY TYPE PARTS SHOWN IN THE PARTS LIST.

⚠

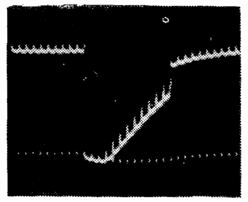
CAUTION: FOR CONTINUED SAFETY, REPLACE SAFETY CRITICAL COMPONENTS ONLY WITH MANUFACTURER'S RECOMMENDED PARTS.
AVERTISSEMENT: POUR MAINTENIR LE DEGRE DE SECURITE DE L'APPAREIL NE REMPLACER LES COMPOSANTS DONT LE FONCTIONNEMENT EST CRITIQUE POUR LA SECURITE QUE PAR DES PIECES RECOMMANDEES PAR LE FABRICANT.

OSCILLOSCOPE WAVEFORM PATTERN

The waveforms shown are as observed on the wide band oscilloscope with the monitor turned to a reasonably strong signal and a normal picture. The voltages shown on each waveform are the approximate peak amplitudes.

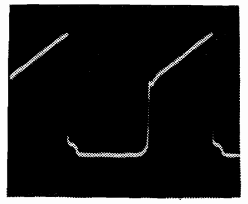
If the waveforms are observed on the oscilloscope with a poor high frequency response, the corner of the pulses will tend to be more rounded than those shown and the amplitude of any high frequency pulse will tend to be less.

A



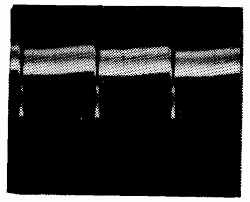
1V/DIV 200uSEC/DIV

Q351 COLLECTOR



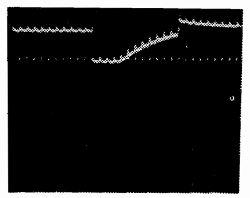
20V/DIV 10uSEC/DIV

TP-81



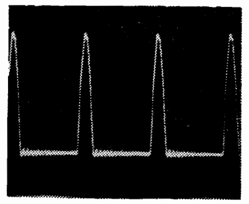
0.5/DIV 5MSEC/DIV

TP-31 DC COUPLED
BOTTOM LINE = 0 VDC



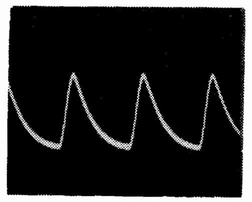
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J402-3



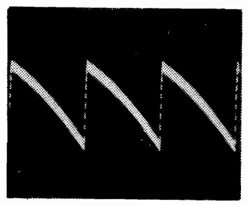
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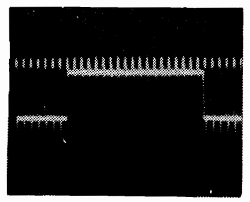
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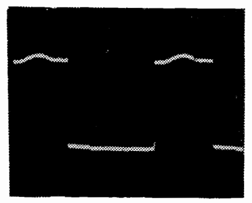
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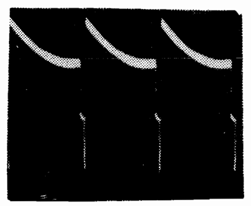
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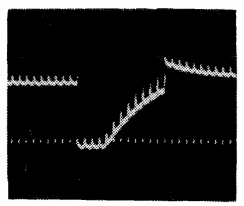
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TP-82



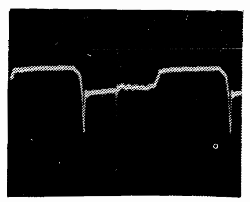
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TP-31, AC COUPLED



1V/DIV 200uSEC/DIV

D



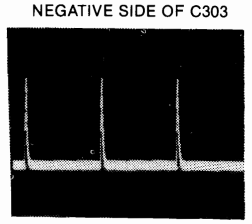
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I.C. 301, PIN 13



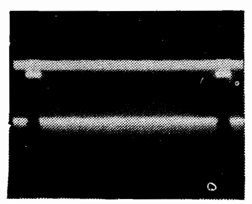
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NEGATIVE SIDE OF C303

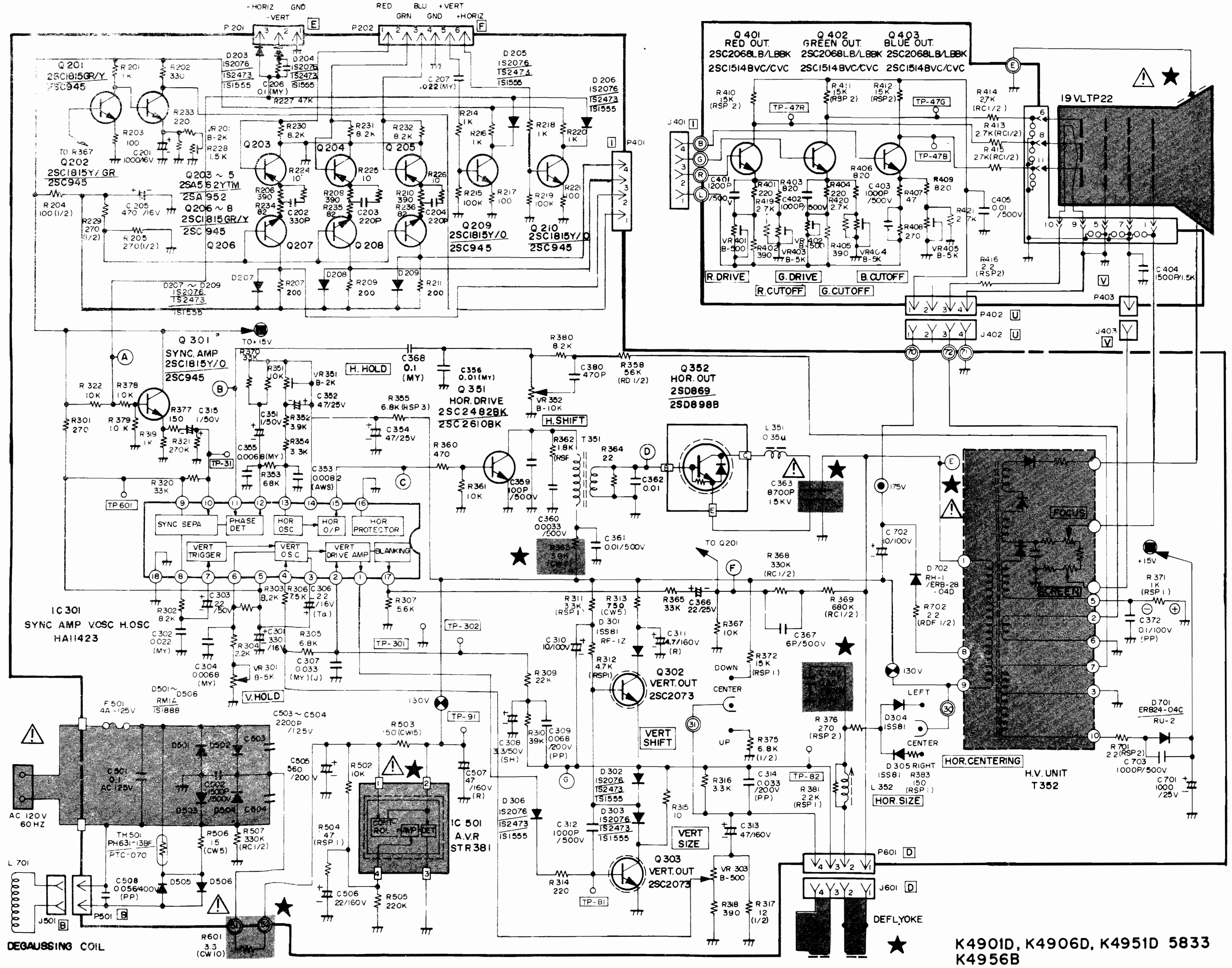


2V/DIV 5MSEC/DIV

F



1VDIV 2MSEC/DIV



K4901D, K4906D, K4951D 5833
K4956B

REPLACEMENT PARTS LIST

This monitor contains circuits and components included specifically for safety purposes.

For continued protection no changes should be made to the original design, and components shown in shaded areas of schematic, or △★ on parts list should be replaced with exact factory replacement parts.

The use of substitute parts may create a shock, fire, radiation or other hazard. Service should be performed by qualified personnel only.

MAIN BOARD

RESISTORS

Ref. No.	Part No.	Description
R201	203X6500-645	1K Ohm, 5%, 1/4W Carbon
R202	203X6500-523	30 Ohm, 5%, 1/4W Carbon
R203	203X6500-405	100 Ohm, 5%, 1/4W Carbon
R204	203X6700-327	100 Ohm, 5%, 1/2W Carbon
R205	203X6700-421	270 Ohm, 5%, 1/2W Carbon
R206	203X6500-540	390 Ohm, 5%, 1/4W Carbon
R207	340X2201-934	200 Ohm, 5%, 1/4W Carbon
R208	203X6500-540	390 Ohm, 5%, 1/4W Carbon
R209	340X2201-934	200 Ohm, 5%, 1/4W Carbon
R210	203X6500-540	390 Ohm, 5%, 1/4W Carbon
R211	340X2201-934	200 Ohm, 5%, 1/4W Carbon
R214	203X6500-645	1K Ohm, 5%, 1/4W Carbon
R215	203X6501-126	100K Ohm, 5%, 1/4W Carbon
R216	203X6500-645	1K Ohm, 5%, 1/4W Carbon
R217	203X6500-405	100 Ohm, 5%, 1/4W Carbon
R218	203X6500-645	1K Ohm, 5%, 1/4W Carbon
R219	203X6501-126	100K Ohm, 5%, 1/4W Carbon
R220	203X6500-645	1K Ohm, 5%, 1/4W Carbon
R221	203X6500-405	100 Ohm, 5%, 1/4W Carbon
R222	203X6500-762	3.3 Ohm, 5%, 1/4W Carbon
R224	203X6500-169	10 Ohm, 5%, 1/4W Carbon
R225	203X6500-169	10 Ohm, 5%, 1/4W Carbon
R226	203X6500-169	10 Ohm, 5%, 1/4W Carbon
R227	203X6501-044	47K Ohm, 5%, 1/4W Carbon
R228	203X6500-645	1K Ohm, 5%, 1/4W Carbon
R229	203X6700-421	270 Ohm, 5%, 1/2W Carbon
R230	203X6500-863	8.2K Ohm, 5%, 1/2W Comp.
R231	203X6500-863	8.2K Ohm, 5%, 1/2W Comp.
R232	203X6500-863	8.2K Ohm, 5%, 1/2W Comp.
R233	203X6500-468	180 Ohm, 5%, 1/4W Carbon
R234	340X2820-934	82 Ohm, 5%, 1/4W Carbon
R235	340X2820-934	82 Ohm, 5%, 1/4W Carbon
R236	340X2820-934	82 Ohm, 5%, 1/4W Carbon
R301	203X6500-508	270 Ohm,5%, 1/4W Carbon
R302	203X6500-863	8.2K Ohm, 5%, 1/4W Carbon
R303	203X6500-863	8.2K Ohm, 5%, 1/4W Carbon
R304	203X6500-724	2.2K Ohm, 5%, 1/4W Carbon
R305	203X6500-842	6.8K Ohm, 5%, 1/4W Carbon
R306	203X6003-201	7.5K Ohm, 2%, 1/4W Carbon
R307	203X6500-825	5.6K Ohm, 5%, 1/4W Carbon
R309	203X6500-965	22K Ohm, 5%, 1/4W Carbon
R310	203X6500-988	39K Ohm, 5%, 1/4W Carbon
R311	203X6500-762	3.3K Ohm, 5%, 1/4W Carbon
R312	203X9014-741	4.7K Ohm, 5%, 1/4W Carbon
R313	204X1450-537	1K Ohm, 5%, 5W Carbon
R314	203X6500-481	220 Ohm, 5%, 1/4W Carbon
R315	203X6500-169	10 Ohm, 5%, 1/4W Carbon
R316	203X6500-762	3.3K Ohm, 5%, 1/4W Carbon
R317	203X6700-107	12 Ohm, 5%, 1/2W Carbon
R318	203X6500-540	390 Ohm, 5%, 1/4W Carbon
R319	203X6500-645	1K Ohm, 5%, 1/4W Carbon
R320	203X6501-002	33K Ohm, 5%, 1/4W Carbon
R321	203X6501-224	270K Ohm, 5%, 1/2W Carbon
R322	203X6500-886	10K Ohm, 5%, 1/4W Carbon
R351	203X6500-886	10K Ohm, 5%, 1/4W Carbon
R352	203X6500-785	3.9K Ohm, 5%, 1/4W Carbon
R353	203X6501-086	68K Ohm, 5%, 1/4W Carbon
R354	203X6500-762	3.3K Ohm, 5%, 1/4W Carbon
R355	203X9205-143	6.8K Ohm, 5%, 3W Metal Oxide
R358	203X5601-878	56K Ohm, 5%, 1/2W Carbon
R360	203X6500-561	470 Ohm, 5%, 1/4W Carbon
R361	203X6500-886	10K Ohm, 5%, 1/4W Carbon
R362	203X9014-645	1.8K Ohm, 5%, 1W Metal Oxide
★R363	204X1527-751	3.9K Ohm, 5%, 7W Metal Oxide
R364	203X6500-246	22 Ohm, 5%, 1/4W Carbon
R365	203X6501-002	33K Ohm, 5%, 1/4W Carbon
R367	203X6500-886	10K Ohm, 5%, 1/4W Carbon
R368	203X5602-185	330K Ohm, 5%, 1/2W Comp.

RESISTORS (CONT.)

Ref. No.	Part No.	Description
R369	203X5602-329	680K Ohm, 5%, 1/2W Comp.
R370	203X6501-002	33K Ohm, 5%, 1/4W Carbon
R371	203X9014-584	1K Ohm, 5%, 1W Metal Oxide
R372	203X9101-119	12K Ohm, 5%, 1W Metal Oxide
R375	203X6700-763	6.8K Ohm, 5%, 1/2W Carbon
R376	203X9104-404	270 Ohm, 5%, 2W Metal Oxide
R377	203X6500-447	150 Ohm, 5%, 1/4W Carbon
R378	203X6500-886	10K Ohm, 5%, 1/4W Carbon
R379	203X6500-886	10K Ohm, 5%, 1/4W Carbon
R380	203X6500-865	8.2K Ohm, 5%, 1/4W Carbon
R381	203X6500-724	2.2K Ohm, 5%, 1W Metal Oxide
R383	203X9014-387	150 Ohm, 5%, 1W Metal Oxide
R502	203X6500-886	10K Ohm, 5%, 1/4W Carbon
R503	204X1700-535	150 Ohm, 5%, 15W Metal Oxide
R504	203X9014-267	47 Ohm, 5%, 1W Metal Oxide
R505	203X6501-209	2.2K Ohm, 5%, 1/4W Carbon
R506	203X9104-105	15 Ohm, 5%, 2W Metal Oxide
R507	203X5602-185	330K Ohm, 5%, 1/2W Comp.
△★R601	204X1625-058	3.3 Ohm, 5%, 10W WW
R701	203X9105-141	2.2 Ohm, 5%, 2W Metal Oxide
R702	203X6206-441	2.2 Ohm, 5%, 1/2W Carbon
VR201	204X2070-072	2K Ohm-B Semi-Fixed
VR301	204X2070-084	5K Ohm-B Semi-Fixed
VR303	204X2070-055	500 Ohm-B Semi-Fixed
VR351	204X2070-072	2K Ohm-B Semi-Fixed
VR352	204X2070-072	2K Ohm-B Semi-Fixed

CAPACITORS

Ref. No.	Part No.	Description
C201	203X0014-088	1000 uF, 16V, Electrolytic
C202	202X7200-064	330 pF, 500V, Ceramic
C203	202X7200-043	220 pF, 500V, Ceramic
C204	202X7200-043	220 pF, 500V, Ceramic
C205	203X0014-076	470 uF, 16V, Electrolytic
C206	203X1810-149	0.1 uF, 125V Mylar
C207	349X2232-109	.022 uF, 100V Mylar
C301	203X0014-065	330 uF, 50V Electrolytic
C302	203X1600-563	0.033 uF, 50V Mylar
C303	203X0629-037	3.3 uF, 50V Electrolytic
C304	203X1600-366	0.068 uF, 50V Mylar
C306	203X0412-012	2.2 uF, 16V Tantal
C307	203X1600-634	0.033 uF, 50V Mylar
C308	203X0025-174	3.3 uF, 50V Electrolytic
C309	203X1207-100	0.068 uF, 100V PP
C310	203X0629-061	10 uF, 100V Electrolytic
C311	203X0041-025	10 uF, 160V Electrolytic
C312	202X7050-248	1000 pF, 500V Ceramic
C313	203X0040-052	47 uF, 160V Electrolytic
C314	203X1201-265	0.033 uF, 200V PP
C315	203X0629-023	1 uF, 50V Electrolytic
C351	203X0629-023	1 uF, 50V Electrolytic
C352	203X0619-045	47 uF, 25V Electrolytic
C353	203X1190-015	0.0082 pF, 50V Mylar-PP
C354	203X0619-045	47 uF, 25V Electrolytic
C355	203X1600-366	0.0068 pF, 50V Mylar
C356	202X7050-483	0.01 uF, 500V Ceramic
C359	202X8065-606	100 pF, 500V Ceramic
C360	202X7050-366	0.0033 pF, 500V Ceramic
C361	202X7050-483	0.01 uF, 500V Ceramic
C362	202X7203-032	0.01 uF, 50V Ceramic
△★C363	203X1270-911	8700 pF, 1.5 KV PP
★C365	203X1201-265	0.33 uF, 200V PP
C366	203X0019-026	22 uF, 25V Electrolytic
C367	202X8065-162	6 pF, 500V Ceramic
C368	202X7203-032	0.01 uF, 50V Ceramic
C372	203X1207-125	0.1 uF, 100V PP

MAIN BOARD (CONT.)

CAPACITORS (CONT.)

Ref. No.	Part No.	Description
C380	202X7200-087	470 uF, 500V Ceramic
△C501	203X1810-149	0.1 uF, 125V Mylar
△C502	202X7050-282	1500 pF, 500V Ceramic
△C503	202X7810-214	2200 pF, 125V Ceramic
△C504	202X7810-214	2200 pF, 125V Ceramic
C505	203X0220-075	560 uF, 200V Electrolytic
C506	203X0040-034	22 uF, 160V Electrolytic
C507	203X0041-057	47 uF, 160V Electrolytic
C701	203X0019-092	1000 uF, 25V Electrolytic
C702	203X0634-061	10 uF, 100V Electrolytic
C703	202X7050-248	1000 pF, 500V Ceramic

SEMICONDUCTORS

Ref. No.	Part No.	Description
D203	201X2010-159	Diode, IS2076-27
D204	201X2010-159	Diode, IS2076-27
D205	201X2010-159	Diode, IS2076-27
D206	201X2010-159	Diode, IS2076-27
D207	201X2010-159	Diode, IS2076-27
D208	201X2010-159	Diode, IS2076-27
D209	201X2010-159	Diode, IS2076-27
D301	201X2010-165	Diode, ISS81
D302	201X2010-159	Diode, IS2076-27
D303	201X2010-159	Diode, IS2076-27
D304	201X2120-009	Diode, RH-IV
D305	201X2120-009	Diode, RH-IV
D306	201X2010-159	Diode, IS2076-27
△D501	201X3120-216	Diode, RM-1AV
△D502	201X3120-216	Diode, RM-1AV
△D503	201X3120-216	Diode, RM-1AV
△D504	201X3120-216	Diode, RM-1AV
D505	201X3120-216	Diode, RM-1AV
D506	201X3120-216	Diode, RM-1AV
D701	201X2130-234	Diode, RU-2V
D702	201X2120-009	Diode, RH-1V
Q201	200X3181-523	Transistor (NPN) 2SC1815GR
Q202	200X3181-523	Transistor (NPN) 2SC1815GR
Q203	200X4056-260	Transistor (PNP) 2SA562-Y-TM
Q204	200X4056-260	Transistor (PNP) 2SA562-Y-TM
Q205	200X4056-260	Transistor (PNP) 2SA562-Y-TM

SEMICONDUCTORS (CONT.)

Ref. No.	Part No.	Description
Q206	200X3181-523	Transistor (NPN) 2SC1815GR
Q207	200X3181-523	Transistor (NPN) 2SC1815GR
Q208	200X3181-523	Transistor (NPN) 2SC1815GR
Q209	200X3181-523	Transistor (NPN) 2SC1851GR
Q210	200X3181-523	Transistor (NPN) 2SC1851GR
Q301	200X3181-523	Transistor (NPN) 2SC1851GR
Q302	200X3207-306	Transistor (NPN) 2SC2073LBGL2
Q303	200X3207-306	Transistor (NPN) 2SC2073LBGL2
Q351	200X3248-217	Transistor (NPN) 2SC2482BK
Q352	200X4589-802	Transistor (NPN) 2SD898B
IC301	200X2300-033	IC HA11423
△★IC501	200X2600-183	IC STR381

TRANSFORMERS & COILS

Ref. No.	Part No.	Description
L351	201X4710-134	Coil, (RF Choke)
L352	201X5000-083	Coil, Horiz. Size
L701	611X0004-007	Coil, Adg.
T351	202X1300-080	Transformer, Hor. Drive
△★T352	200X9720-301	HV-Unit M-11

MISCELLANEOUS

Ref. No.	Part No.	Description
△F501	204X7120-073	Fuse, 4 Amp. 125V
J402	206X5008-632	Recep W Wire 3P-M-BG
P201	204X9600-466	Plug, PWB 3P-J
P202	204X9601-477	Plug, PWB 6P-Q
P401	204X9600-298	Plug, PWB 4P-B
P501	204X9600-249	Plug, PWB 2P-B
P601	204X9600-304	Plug, PWB 4P-C
TH501	201X0100-112	Thermistor

FINAL ASSEMBLY PARTS

Ref. No.	Part No.	Description
	△★88X0138-506	19VLTP22 Pix Tube
	205X9800-158	Lateral/Purity Assembly
	△★202X1111-201	Yoke Deflection
	204X9301-255	CRT Socket
	291X5004-262	Automatic Degaussing Coil Unit

NECK BOARD

RESISTORS

Ref. No.	Part No.	Description
R401	203X6000-729	220 Ohm, 5% 1/4W Carbon
R402	203X6500-540	390 Ohm, 5% 1/4W Carbon
R403	203X6000-661	820 Ohm, 5% 1/4W Carbon
R404	203X6000-729	220 Ohm, 5% 1/4W Carbon
R405	203X6500-540	390 Ohm, 5% 1/4W Carbon
R406	203X6000-661	820 Ohm, 5% 1/4W Carbon
R407	203X6000-729	470 Ohm, 5% 1/4W Carbon
R408	203X6000-998	270 Ohm, 5% 1/4W Carbon
R409	203X6000-661	820 Ohm, 5% 1/4W Carbon
R410	203X9104-824	15K Ohm, 5% 2W M.O. Forming
R411	203X9104-824	15K Ohm, 5% 2W M.O. Forming
R412	203X9104-824	15K Ohm, 5% 2W M.O. Forming
R413	203X6000-998	2.7K Ohm, 5% 1/2W Comp.
R414	203X6000-998	2.7K Ohm, 5% 1/2W Comp.
R415	203X6000-998	2.7K Ohm, 5% 1/2W Comp.
R416	203X9105-154	2.2 Ohm, 5% 2W Metal Oxide
R419	203X6500-741	2.7K Ohm, 5% 1/4W Carbon
R420	203X6500-741	2.7K Ohm, 5% 1/4W Carbon
R421	203X6500-741	2.7K Ohm, 5% 1/4W Carbon
VR401	204X2115-014	500 Ohm, -B Semi-Fixed
VR402	204X2115-014	500 Ohm, -B Semi-Fixed
VR403	204X2115-006	5K Ohm, -B Semi-Fixed
VR404	204X2115-006	5K Ohm. -B Semi-Fixed
VR405	204X2115-006	5K Ohm, -B Semi-Fixed

CAPACITORS

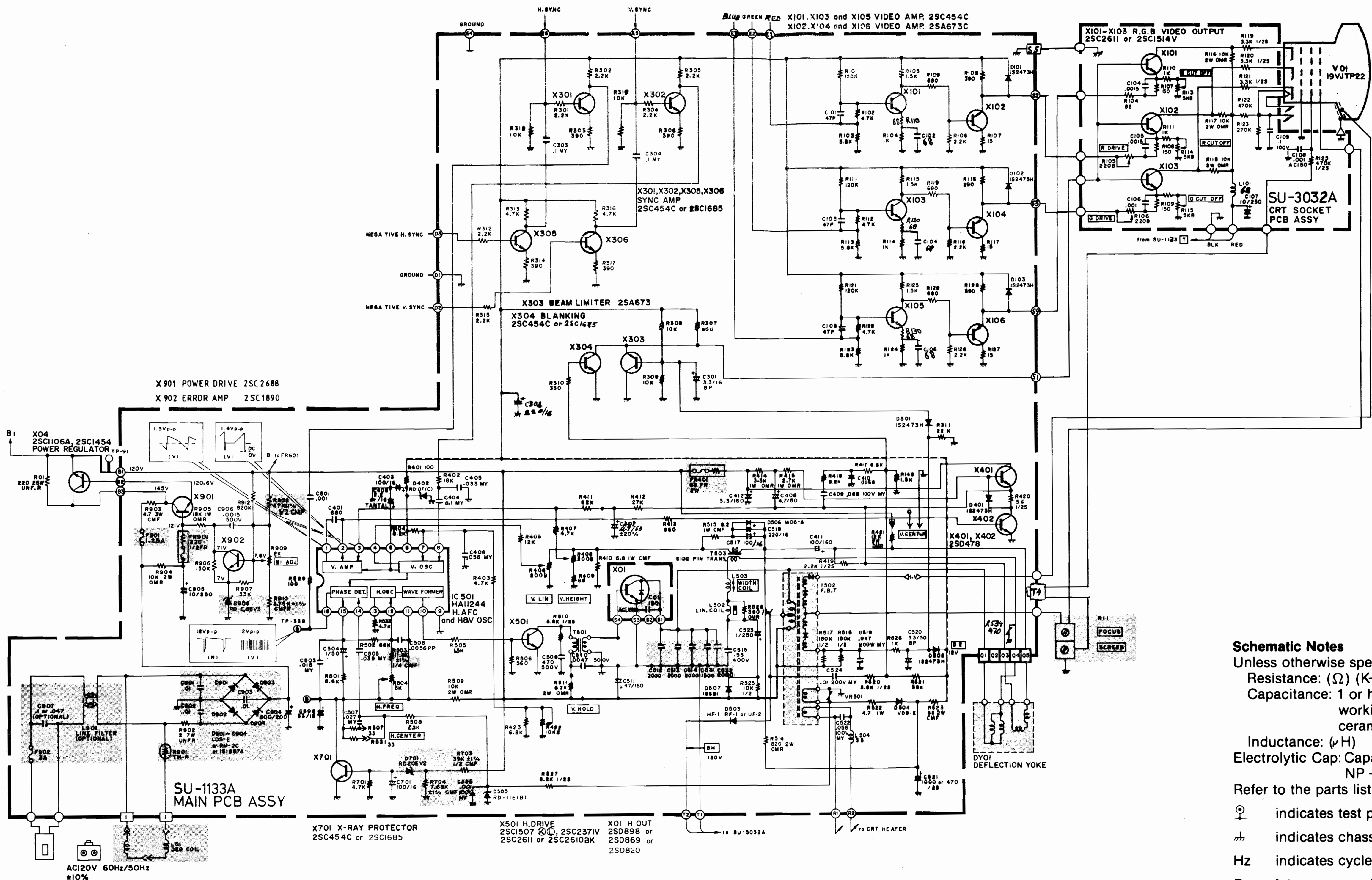
Ref. No.	Part No.	Description
C401	202X7050-269	1200 pF, 500V Ceramic
C402	202X7050-248	1000 pF, 500V Ceramic
C403	202X7050-248	1000 pF, 500V Ceramic
C404	202X7050-282	1500 pF, 1.5KV Ceramic
C405	202X7050-483	0.01 uF, 500V Ceramic

SEMICONDUCTORS

Ref. No.	Part No.	Description
Q401	200X3206-800	Transistor (NPN) 2SC2068LB
Q402	200X3206-800	Transistor (NPN) 2SC2068LB
Q403	200X3206-800	Transistor (NPN) 2SC2068LB

MISCELLANEOUS

Ref. No.	Part No.	Description
J401	206X5009-296	RECEP W Wire 4P-E
P402	204X9600-254	Plug, PWB 3P-A
P403	204X9600-981	Plug, Pin 1P-D
P701	204X9601-020	Plug, PWB 4P-E



Schematic Notes

Unless otherwise specified

Resistance: (Ω) (K→KΩ, M→MΩ), 1/4 (W) carbon resistor

Capacitance: 1 or higher→ (pF), less than 1→ (μF)
working voltage→ 50 (V)
ceramic capacitor

Inductance: (μH)

Electrolytic Cap: Capacitance Value (μF)/working voltage (V),
NP → non-polar (or bipolar) electrolytic cap.

Refer to the parts list for additional component information.

- indicates test point connection
- indicates chassis ground unless otherwise specified

Hz indicates cycles per second

For **safety** purposes (and continuing reliability)

⚠ replace all components marked with safety symbol with identical type.

NOTE: FR → fusible resistor

Parts identification on circuit boards:
e.g. SU1126A (R107 = R**1**107)
SU3030A (R113 = R**3**113)

00-4147-04
G07-CB0

REPLACEMENT PARTS LIST—ELECTROHOME 19" MONITOR

> Components identified by the △ symbol in the PARTS LIST and on the Schematic have special characteristics important to safety.
>
> DO NOT degrade the safety of the set through improper servicing.

Abbreviations for Resistors and Capacitors

Resistor		Capacitor	
C R	: Carbon Resistor	C Cap.	: Ceramic Capacitor
Comp. R	: Composition Resistor	M Cap.	: Mylar Capacitor
OM R	: Oxide Metal Film Resistor	E Cap.	: Electrolytic Capacitor
V R	: Variable Resistor	BP E Cap.	: Bi-Polar (or Non-Polar) Electrolytic Capacitor
MF R	: Metal Film Resistor	MM Cap.	: Metalized Mylar Capacitor
CMF R	: Coating Metal Film Resistor	PP Cap.	: Polypropylene Capacitor
UNF R	: Nonflammable Resistor	MPP Cap.	: Metalized PP Capacitor
F R	: Fusible Resistor	PS Cap.	: Polystyrol Capacitor
		Tan. Cap.	: Tantal Capacitor

NOTE: When ordering replacement parts please specify the part number as shown in this list including part name, and model number. Complete information will help expedite the order.

Use of substitute replacement parts which do not have the same safety characteristics as specified, may create shock, fire or other hazards. For maximum reliability and performance, all parts should be replaced by those having identical specifications.

SERVICE REPLACEMENT PARTS LIST

Symbol	Description	Part Number
	Main P.C.B. Ass'y	SU-1133A
	CRT Socket P.C.B. Ass'y	SU-3032A
	Purity Shield Ass'y	07-220083-03

Outside of the P.C.B. Ass'y

Symbol	Description	Part Number
	Picture Tube 19"	17-7198-03
△	△Deflection Yoke	A29779-D=21-141-01
	PC Magnet	A75034-B=29-32-01
△	△Flyback Transf.	A29951-B
△	△HVR	A46600-A
R05	UNF Resistor 220Ω,25W K	QRF258K-221
C04	C Capacitor 150pF, AC1.5KV	QCZ0101-005
X01	Si. Transistor	2SD870
X02	Si. Transistor	2SC1106A
SC	Screw #8-⅜	31-610818-06
SC	Screw ¼ x ¾ Pix Tube Mtg. (4)	31-601418-12
WA	Pyramidal Lock Washer (4)	33-255-01
	Nut Retainer, Pix Tube Mtg. (4)	33-494-01
	Clip—P.C.B. Support	33-629-02
	Standoff	33-670-010R-02
	Wire Terminal (Gnd. Strap)	34-228-03
	Terminal Lug (Gnd.)	34-33-04
	Groundstrap Assy.	34-574-02
	Grounding Spring	35-212-03
	Wire Hook (Gnd. Strap)	35-3053-02
	Purity Shield Holddown Clamp	35-2348-01
	Support Brkt. RH	35-3890-01
	Support Brkt. LH	35-3890-02
	Chassis Base	38-449-02
	Yoke Wedge (3)	39-1233-01

Purity Shield Ass'y. Parts List

Symbol	Description	Part Number
	Degaussing Coil	21-1007-30
D911, D912	Rectifier 1 Amp 600V (2)	28-22-27
	Pin Terminal (2)	34-708-01
	Pin Terminal Housing	34-709-01
	Purity Shield (2 pcs.)	35-3847-01
	Purity Shield (2 pcs.)	35-3847-02
C911	Capacitor 100nF 10% 400V	48-171544-62
R921	Resistor, Wirewound 33Ω, 4W	42-113301-03
	Fire Retardant Term. Strip 4 Lug	34-492-09

CRT Socket P.C.B. Ass'y (SU-3032A) Parts List

Resistors

Symbol	Description			Part Number
R3105	V	R	200	QVZ3234-022
R3106	V	R	200	QVZ3234-022
R3113	V	R	5K	QVZ3234-053
R3114	V	R	5K	QVZ3234-053
R3115	V	R	5K	QVZ3234-053
R3116	OM	R	10KΩ2W J	QRG029J-103
R3117	OM	R	10KΩ2W J	QRG029J-103
R3118	OM	R	10KΩ2W J	QRG029J-103
R3119	Comp.	R	3.3KΩ½W K	QRZ0039-332
R3120	Comp.	R	3.3KΩ½W K	QRZ0039-332
R3121	Comp.	R	3.3KΩ½W K	QRZ0039-332

Capacitors

Symbol	Description			Part Number
C3107	E	Cap.	10uF 250V A	QEW53EA-106
C3108	C	Cap.	1000pF DC1400V P	QCZ9001-102M

CRT Socket P.C.B. Ass'y (SU-3032A) Parts List (Cont.)

Coils

Symbol	Description	Part Number
L3101	Peaking Coil	QQL043K-101

Semi-conductors

Symbol	Description	Part Number
X3101	Si. Transistor	2SC1514VC
X3102	Si. Transistor	2SC1514VC
X3103	Si. Transistor	2SC1514VC

Miscellaneous

Symbol	Description	Part Number
△	△CRT Socket	A76068

Main PCB Ass'y (SU-1133A) Parts List

Resistors

Symbol	Description			Part Number
R1406	V	R	200Ω	QVZ3230-002
R1408	V	R	200Ω	QVZ3230-002
R1410	CMF	R	6.8Ω1W J	QRX019J-6R8
R1414	OM	R	3.3KΩ1W J	QRG019J-332
R1415	OM	R	2.7KΩ1W J	QRG019J-272
R1421	OM	R	12KΩ2W J	QRG026J-123Z
R1422	V	R	10KΩ	QVZ3230-014
△FR1401	△F	R	68Ω2W K	QRH024K-680M
△R1503	△CMF	R	11.8KΩ¼W+1%	QRV142F-1182
R1504	V	R	5KΩ	QVZ3230-053
R1509	OM	R	10KΩ2W J	QRG026J-103Z
R1512	OM	R	8.2KΩ2W J	QRG026J-822Z
R1514	OM	R	820Ω2W J	QRG026J-821Z
R1515	CMF	R	8.2Ω1W J	QRX019J-8R2
R1522	CMF	R	4.7Ω1W J	QRX019J-4R7
R1523	OM	R	68Ω2W J	QRG026J-680Z
R1528	OM	R	390Ω1W J	QRG019J-391
R1534	ZN	R		ERZ-C05ZK471
VR1501	ZN	R		ERZ-C05ZK271
△R1703	△CMF	R	39Ω½W+1%	QRV122F-3902
△R1704	△CMF	R	7.68KΩ¼W+1%	QRV142F-7681
△R1901	△Posistor			A75414
R1902	UNF	R	2Ω7W K	QRF076K-2R0
R1903	CMF	R	4.7Ω3W J	QRX039J-4R7
R1904	OM	R	10KΩ2W J	QRG026J-103Z
R1905	OM	R	18KΩ1W J	QRG019J-183
△Q1908	△CMF	R	47Ω½W+1%	QRV122F-470Z
△R1909	V	R	2KΩ	QVP5A0B-023E
R1910	△CMF	R	2.74KΩ¼W+1%	QRV142F-274I
△FR1901	△F	R	220Ω½W K	QRH124K-221M

Capacitors

Symbol	Description			Part Number
C1301	BPE	Cap.	3.3uF 50V A	QEN61HA-335Z
C1402	Tan	Cap.	2.2uF 16V K	QEE51CK-225B
C1407	E	Cap.	4.7uF 6.3V A	QEW51JA-475
C1411	E	Cap.	100uF 160V A	QEW52CA-107
C1412	E	Cap.	3.3uF 160V A	QEW52CA-335
C1508	PP	Cap.	5600uF 50V J	QFP31HJ-562
△C1512	△PP	Cap.	2000pF DC1500V J	QFZ0082-202
△C1513	△PP	Cap.	2000pF DC1500V J	QFZ0082-202
△C1514	△PP	Cap.	2000pF DC1500V J	QFZ0082-202
C1515	PP	Cap.	0.53uF DC1200V J	QFZ0067-534
C1520	BPE	Cap.	3.3uF 50V A	QEN61HA-335Z
C1523	E	Cap.	1uF 160V A	QEW62CA-105Z
C1524	M	Cap.	0.1uF 200V K	QFM720K-104M
△C1531	△PP	Cap.	2000pF DC1500V J	QFZ0082-202
△C1532	△PP	Cap.	1500pF DC1500V J	QFZ0082-152
C1904	E	Cap.		QEY0034-001
C1905	E	Cap.	10uF 250V A	QEW52EA-106

Main PCB Ass'y (SU-1133A) Parts List (Cont.)

Coils

Symbol	Description	Part Number
L1502	Linarity Coil	A39835
L1503	Width Coil	C30380-A
L1504	Heater Choke	C30445-A

Transformers

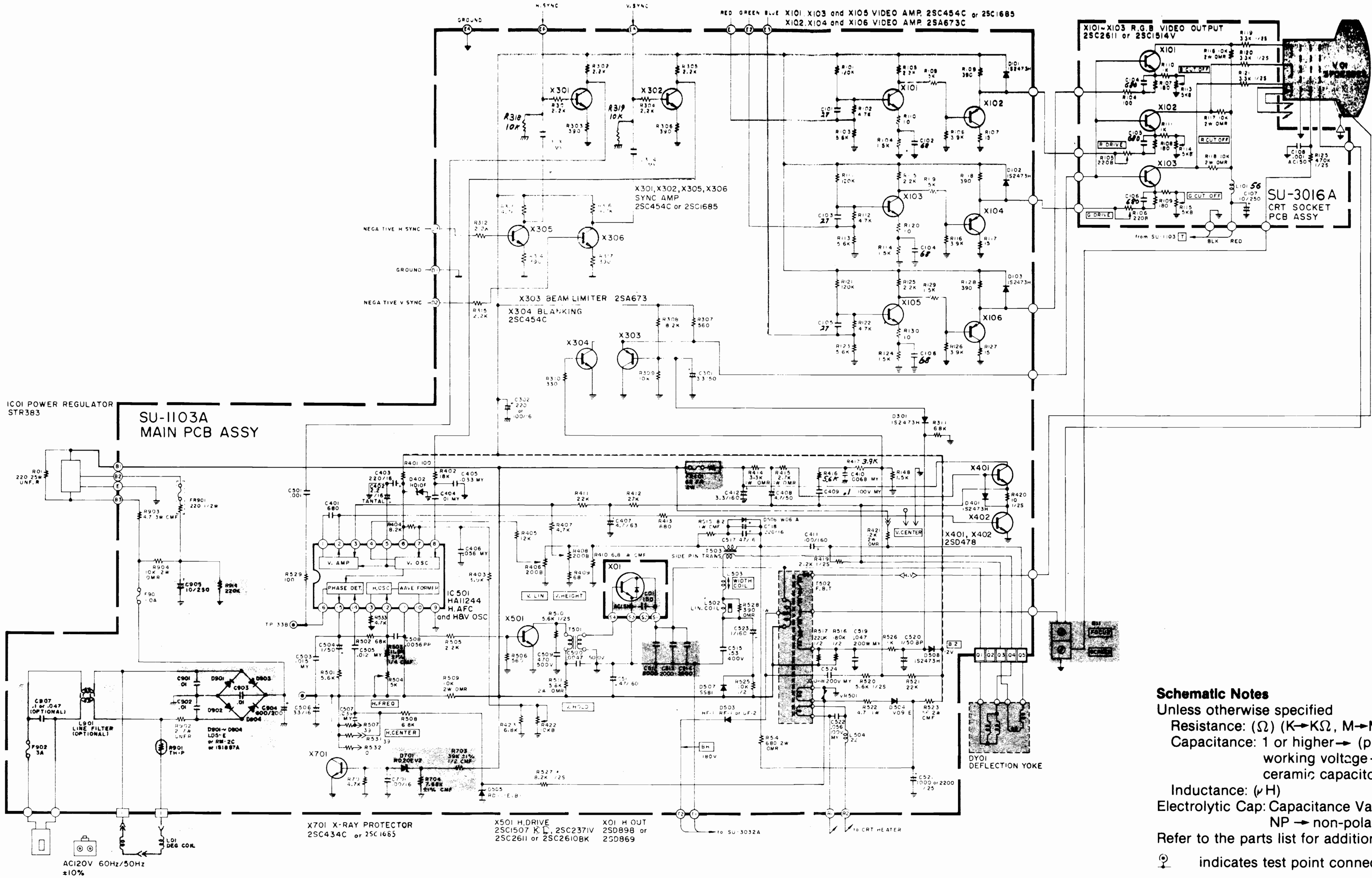
Symbol	Description	Part Number
T1501	Hor. Drive Transf.	A46022-BM
T1503	Side Pin Transf.	C39050-A

Semi-conductors

Symbol	Description	Part Number
IC1501	IC	HA11244
X1101	Si. Transistor	2SC1685(R)
X1102	Si. Transistor	2SA673(C)
X1103	Si. Transistor	2SC1685(R)
X1104	Si. Transistor	2SA673(C)
X1105	Si. Transistor	2SC1685(R)
X1106	Si. Transistor	2SA673(C)
X1301	Si. Transistor	2SC1685(R)
X1302	Si. Transistor	2SC1685(R)
X1303	Si. Transistor	2SA673(C)
X1304	Si. Transistor	2SC1685(R)
X1305	Si. Transistor	2SC1685(R)
X1401	Si. Transistor	2SD478
X1402	Si. Transistor	2SD478
X1501	Si. Transistor	2SC2610BK
X1901	Si. Transistor	2SC2688 (K.L.M.)
X1902	Si. Transistor	2SC1890A (E.F.)
D1101	Si. Diode	W06A
D1102	Si. Diode	W06A
D1103	Si. Diode	W06A
D1301	Si. Diode	1SZ473H
D1401	Si. Diode	1SZ473H
D1402	Zener Diode	RD10F(C)
D1503	Si. Diode	HF-1
D1504	Si. Diode	V09E
D1505	Zener Diode	RD11E(B)
D1506	Si. Diode	W06A
D1507	Si. Diode	1SS81
D1508	Si. Diode	1SZ473H
△D1701	△Zener Diode	RD20EV2
△D1901	△Si. Diode	1S1887A
△D1902	△Si. Diode	1S1887A
△D1903	△Si. Diode	1S1887A
△D1904	△Si. Diode	1S1887A
△D1905	△Zener Diode	RD6.8EV3

Miscellaneous

Symbol	Description	Part Number
△F1901	△Fuse 1.25A	QMF53U1-1R25S
△F1902	△UL Fuse 3A	QMF66U1-3R0S



Schematic Notes

Unless otherwise specified

Resistance: (Ω) (K→KΩ, M→MΩ), 1/4 (W) carbon resistor

Capacitance: 1 or higher→ (pF), less than 1→ (μF)
working voltage→ 50 (V)
ceramic capacitor

Inductance: (μH)

Electrolytic Cap: Capacitance Value (μF)/working voltage (V),
NP → non-polar (or bipolar) electrolytic cap.

Refer to the parts list for additional component information.

- indicates test point connection
- indicates chassis ground unless otherwise specified
- Hz indicates cycles per second

For **safety** purposes (and continuing reliability)

⚠ replace all components marked with safety symbol with identical type.
NOTE: FR → fusible resistor

Parts identification on circuit boards:
e.g. SU1126A (R107 = R**1**107)
SU3030A (R113 = R**3**113)

G07-FBO
00-4147-03

REPLACEMENT PARTS LIST—ELECTROHOME 13" MONITOR

Components identified by the △ symbol in the PARTS LIST and on the Schematic have special characteristics important to safety.

DO NOT degrade the safety of the set through improper servicing.

Abbreviations for Resistors and Capacitors

Resistor

C R	:	Carbon Resistor
Comp. R	:	Composition Resistor
OM R	:	Oxide Metal Film Resistor
V R	:	Variable Resistor
MF R	:	Metal Film Resistor
CMF R	:	Coating Metal Film Resistor
UNF R	:	Nonflammable Resistor
F R	:	Fusible Resistor

Capacitor

C Cap.	:	Ceramic Capacitor
M Cap.	:	Mylar Capacitor
E Cap.	:	Electrolytic Capacitor
BP E Cap.	:	Bi-Polar (or Non-Polar) Electrolytic Capacitor
MM Cap.	:	Metalized Mylar Capacitor
PP Cap.	:	Polypropylene Capacitor
MPP Cap.	:	Metalized PP Capacitor
PS Cap.	:	Polystyrol Capacitor
Tan. Cap.	:	Tantal Capacitor

NOTE: When ordering replacement parts please specify the part number as shown in this list including part name, and model number. Complete information will help expedite the order.

Use of substitute replacement parts which do not have the same safety characteristics as specified, may create shock, fire or other hazards. For maximum reliability and performance, all parts should be replaced by those having identical specifications.

SERVICE REPLACEMENT PARTS LIST

Symbol	Description	Part Number
	Main P.C.B. Ass'y	SU-1103A
	CRT Socket P.C.B. Ass'y	SU-3016A

Outside of the P.C.B. Ass'y

Symbol	Description	Part Number
△V01	△Picture Tube 13"	370ESB22(E)
△DY01	△Deflection Yoke	C29123-V
	PC Magnet	A76366-A
	Wedge	C30006
	△Flyback Transf.	A19183-A
△R11	△Focus V R	A46606-A
△R05	UNF Resistor 220Ω,25W. K	QRF258K-221
△C04	△C Capacitor 150pF, A C1.5KV	QCZ0101-005
X01	Si. Transistor	2SD869
IC01	IC Regulator	STR383
L01	Degaussing Coil	21-1007-31
	Degaussing Coil Pin Terminal (2)	34-708-01
	Degaussing Coil Pin Terminal Housing	34-709-01
	Groundstrap Ass'y	34-697-04
	Groundstrap Wire Terminal	34-228-03
	Groundstrap Spring (2)	35-3560-01
BR	Support Bracket RH	35-3919-01
BR	Support Bracket LH	35-3919-02
SC	SCREW 10-½ Pix Tube Mtg. (4)	31-631018-08
WA	Pyramidal Lockwasher (4)	33-255-01
	Clip P.C.B. Support (2)	33-629-02
	Ground Lug	34-33-04
CH	Chassis Base	38-452-01

Main P.C.B. Ass'y (SU-1103A) Parts List

Resistors

Symbol	Description	Part Number
R1406	V R 200Ω	QVZ3230-022
R1408	V R 200Ω	QVZ3230-022
R1410	CMF R 6.8Ω1W J	QRX019J-6R8
R1414	OM R 3.3KΩ1W J	QRG019J-332
R1415	OM R 2.7KΩ1W J	QRG019J-272
R1421	OM R 12KΩ2W J	QRG029J-123
R1422	V R 10KΩ	QVZ3224-014H
△FR1401	△F R 68Ω2W K	QRH024K-680M
△R1503	△CMF R 11.8Ω¼W +1%	QRV142F-1182
R1504	V R 5KΩ	QVZ3230-053
R1509	OM R 10KΩ2W J	QRG029J-103
R1511	OM R 5.6KΩ2W J	QRG029J-562
R1514	OM R 680Ω2W J	QRG029J-681
R1515	CMF R 8.2Ω1W J	QRX019J-8R2
R1522	CMF R 4.7Ω1W J	QRX019J-4R7
R1523	OM R 56Ω2W J	ORG029J-560
R1528	OM R 390Ω1W J	ORG019J-391
R1534	ZN R	ERZ-C05ZK471
VR1501	ZN R	ERZ-C05DK271
△R1703	△CMF R 39KΩ½W +1%	QRV122F-3902
△R1704	△CMF R 7.68KΩ¼W +1%	QRV142F-7681
△R1901	△Posistor	A75414
R1902	UNF R 2Ω7W K	QRF076K-2R0
R1903	CMF R 5.6Ω3W J	QRX039J-5R6
R1904	OM R 10KΩ2W J	QRG026J-103Z
△FR1901	△F R 220Ω½W K	QRH124K-221M

Main P.C.B. Ass'y (SU-1103A) Parts List

Capacitors

Symbol	Description	Part Number
C1402	Tan. Cap. 2.2uF 16V K	QEE51CK-225B
C1411	E Cap. 100uF 160V A	QEW52CA-107
C1412	E Cap. 3.3uF 160V A	QEW52CA-335
C1508	PP Cap. 5600pF 50V J	QFP31HJ-562
C1511	E Cap. 47uF 160V A	QEW52CA-476S
△C1512	△PP Cap. 2000pF DC1500V J	QFZ0082-202
△C1513	△PP Cap. 2000pF DC1500V J	QFZ0082-202
△C1514	△PP Cap. 2500pF DC1500V J	QFZ0082-252
C1515	PP Cap. 0.53uF DC1200V K	QFZ0067-534
C1520	BPE Cap. 1uF 50V A	QEN61HA-105Z
C1524	M Cap. 0.1uF 200V K	QFM72DK-682M
C1904	E Cap.	QEY0034-001
C1905	E Cap. 10uF 250V A	QEW52EA-106
△C1907	△MM Cap. 0.1uF AC150V Z	QFZ9008-104

Coils

Symbol	Description	Part Number
L1501	Peaking Coil	A75360-6
L1502	Liniarty Coil	A39934
L1503	Width Coil	C30380-A
L1504	Heater Choke	C30333-A
L1901	Line Filter	A39475-J

Transformers

Symbol	Description	Part Number
T1501	Hor. Drive Transf.	A46022-BM
T1503	Side Pin Transf.	C39050-A

Semi-conductors

Symbol	Description	Part Number
IC1501	I.C.	HA11244
X1101	Si. Transistor	2SC1685(R)
X1102	Si. Transistor	2SA673(C)
X1103	Si. Transistor	2SC1685(R)
X1104	Si. Transistor	2SA673(C)
X1105	Si. Transistor	2SC1685(R)
X1106	Si. Transistor	2SA673(C)
X1301	Si. Transistor	2SC1685(R)
X1302	Si. Transistor	2SC1685(R)
X1303	Si. Transistor	2SA673(C)
X1304	Si. Transistor	2SC1685(R)
X1305	Si. Transistor	2SC1685(R)
X1401	Si. Transistor	2SD478
X1402	Si. Transistor	2SD478
X1501	Si. Transistor	2SC2610BK
X1701	Si. Transistor	2SC1685(P-S)
D1101	Si. Diode	W06A
D1102	Si. Diode	W06A
D1103	Si. Diode	W06A
D1301	Si. Diode	1S2473H
D1401	Si. Diode	1S2473H
D1402	Zener Diode	RD10F(C)
D1503	Si. Diode	HF-1
D1504	Si. Diode	V09E
D1505	Zener Diode	RD11E(B)
D1506	Si. Diode	W06A
D1507	Si. Diode	1SS81
D1508	Si. Diode	1S2473H
△D1701	△Zener Diode	D20EV2
△D1901	△Si. Diode	1S1887A
△D1902	△Si. Diode	1S1887A
△D1903	△Si. Diode	1S1887A
△D1904	△Si. Diode	1S1887A

Miscellaneous

Symbol	Description	Part Number
△F1901	△Fuse 1A	QMF53U1-1R0S
△F1902	△UL Fuse 3A	QMF66U1-3R0S

CRT Socket P.C.B. Ass'y (SU-3016A) Parts List

Resistors

Symbol	Description	Part Number
R3105	V R 200Ω	QVZ3234-022
R3106	V R 200Ω	QVZ3234-022
R3113	V R 5KΩ	QVZ3234-053
R3114	V R 5KΩ	QVZ3234-053
R3115	V R 5KΩ	QVZ3234-053
R3116	OM R 10KΩ2W J	QRG029J-103
R3117	OM R 10KΩ2W J	QRG029J-103
R3118	OM R 10KΩ2W J	QRG029J-103
R3119	Comp. R 3.3KΩ½W K	QRZ0039-332
R3120	Comp. R 3.3KΩ½W K	QRZ0039-332
R3121	Comp. R 3.3KΩ½W K	QRZ0039-332

Capacitors

Symbol	Description	Part Number
C3107	E Cap. 10uF 250V A	QEW52EA-106
C3108	C Cap. 1000pF DC1400V P	QCZ9001-102M

Coils

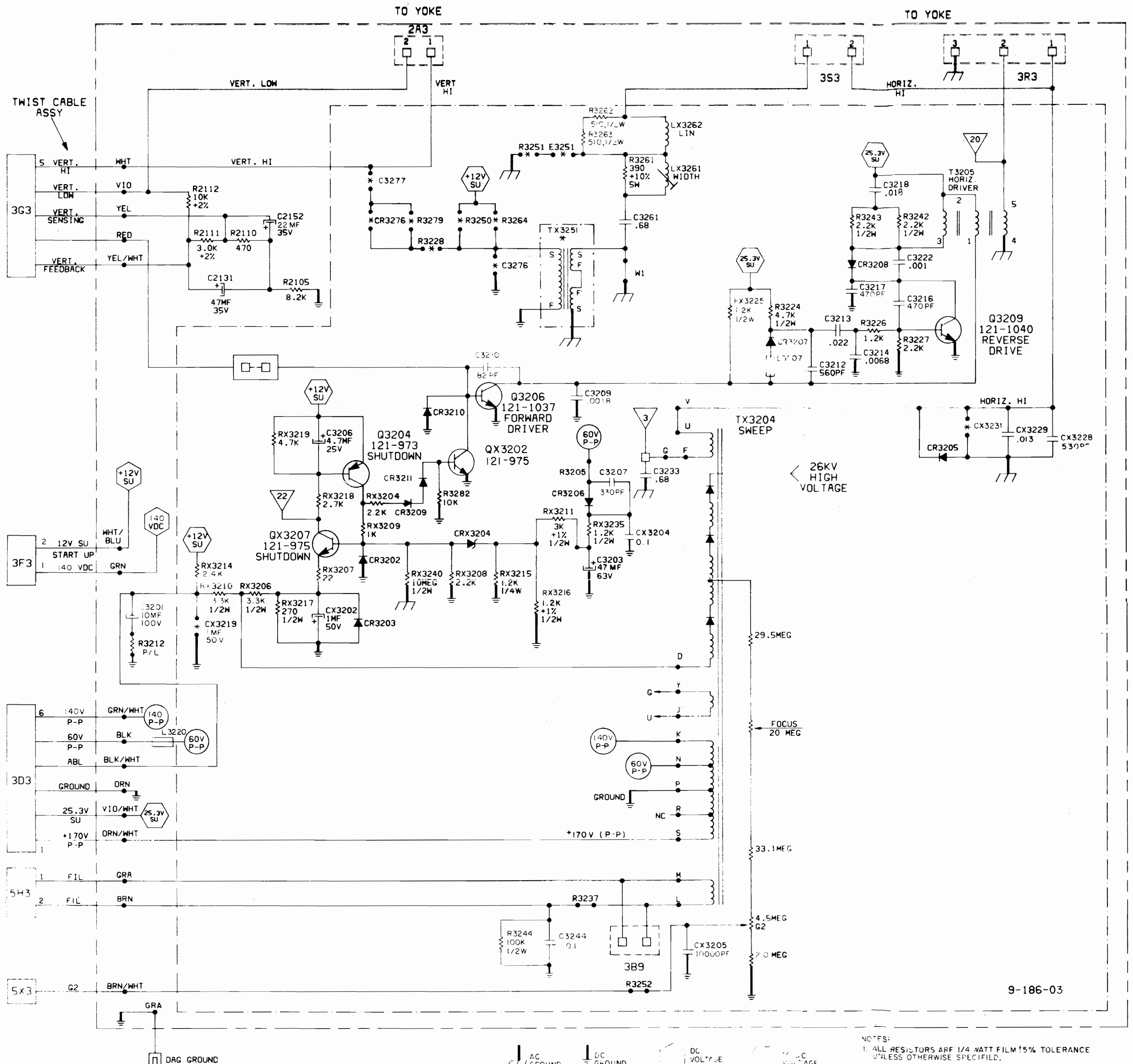
Symbol	Description	Part Number
L3101	Peaking coil	QQL043K-101

Semiconductors

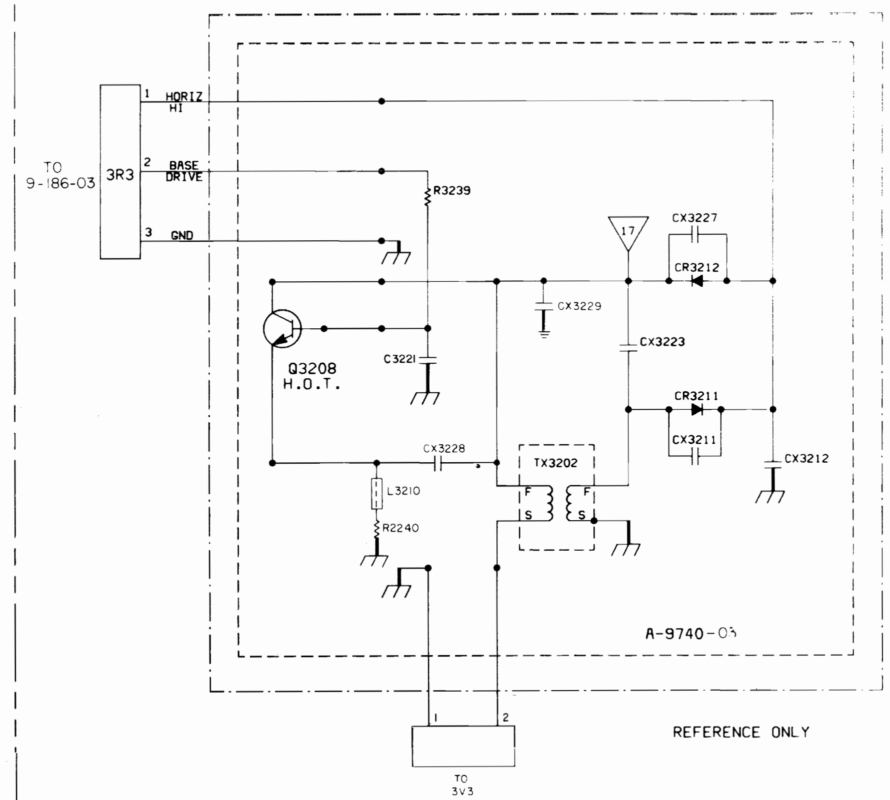
Symbol	Description	Part Number
X3101	Si. Transistor	2SC2611
X3102	Si. Transistor	2SC2611
X3103	Si. Transistor	2SC2611

Miscellaneous

Symbol	Description	Part Number
△	CRT Socket	A75522



NOTES:
1. ALL RESISTORS ARE 1/4 WATT FILM ±5% TOLERANCE UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITORS ARE IN MICROFARADS UNLESS OTHERWISE SPECIFIED.



REFERENCE ONLY

SCHEMATIC FOR
9-186-03
SWEEP BOARD
RGB COLOR MONITOR

ZENITH RADIO CORP. CHICAGO, ILL.	ISSUE B	9-186

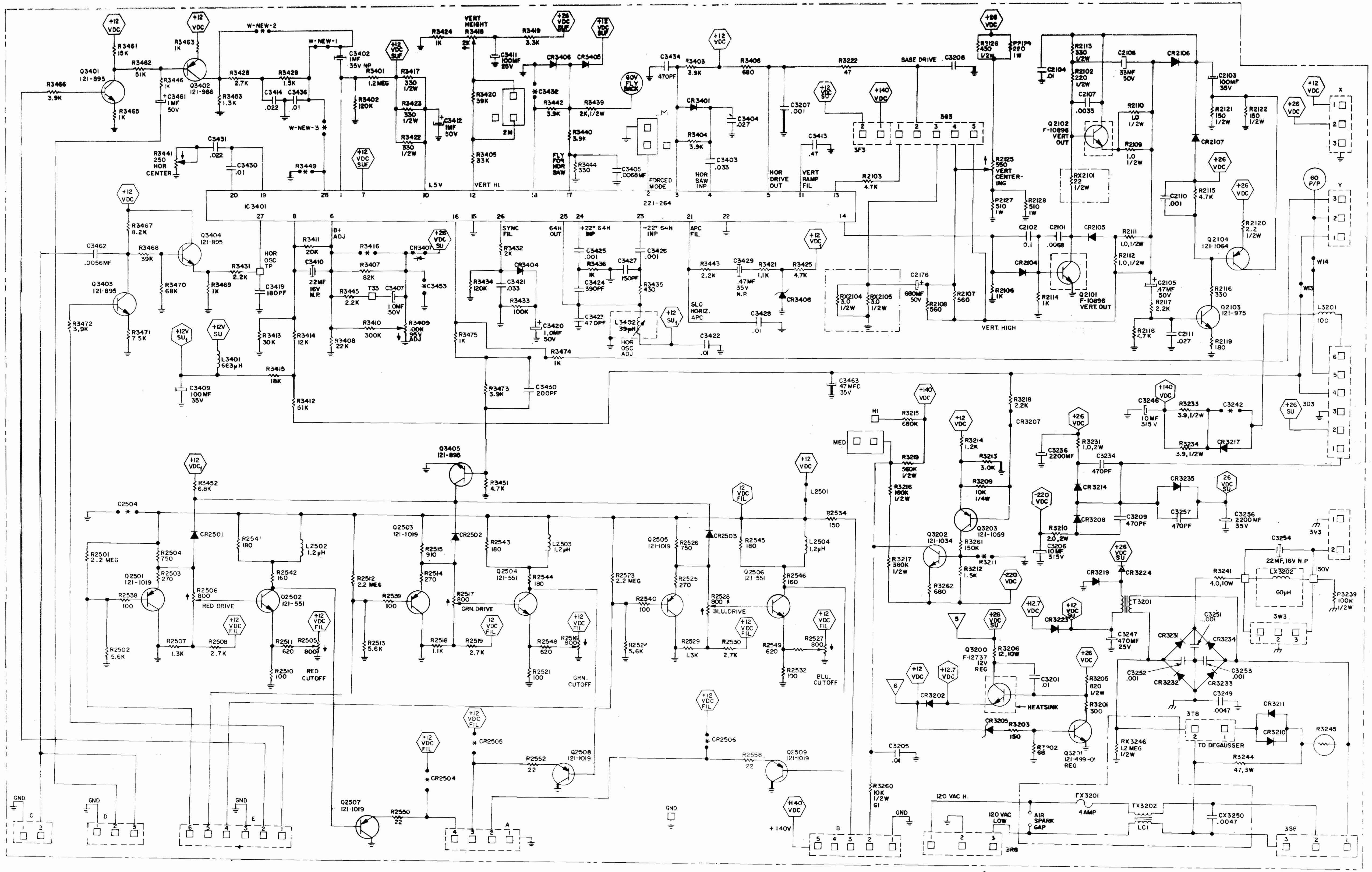
M051-00087-A021

NOTES: (USED WITH CIRCUIT REFERENCE DESIGNATORS)
A. P/L - SEE PARTS LIST FOR APPLICABLE USAGE.
B. —●—●— - JUMPER WIRE USED INSTEAD.
C. —●✱●— PROVISION ON PRINTED CIRCUIT BOARD.

SWEEP BOARD (9-186-03)

Ref. No.	Part No.	Description
CAPACITORS		
C2131	22-7508	47 MF, 35V, ±20% Electrolytic
C2152	22-7508-01C	22 MF, 35V, ±20% Electrolytic
C3201	22-7410-05	10 MF, 100V, ±20% Electrolytic
CX3202	22-7710-01C	1 MF, 50V, +50%−10% Electrolytic
C3203	22-7711-08C	47 MF, 63V, +50%−10% Electrolytic
CX3204	22-7773-24A	0.1 MF, 100V, ±5% Polyester
CX3205	22-7523-01	0.01 MF, 2KV, ±20% Disc
C3206	22-7708-04C	4.7 MF, 25V, +50%−10% Electrolytic
C3207	22-5665	330 PF, 1000V, ±10% Disc
C3209	22-7242	0.0018 MF, 200V, ±10% Disc
C3211	22-7777-20B	0.047 MF, 200V, ±10% Polyester
C3212	22-7234	560 PF, 500V, ±10% Disc
C3213	22-7775-16A	0.022 MF, 100V, ±20% Polyester
C3214	22-7775-10A	0.0068 MF, 100V, ±20% Polyester
C3216	22-5684	470 PF, 500V, ±20% Disc
C3217	22-5684	470 PF, 500V, ±20% Disc
C3218	22-7774-15C	0.018 MF, 100V, ±10% Polyester
C3222	22-7742-10	0.001 MF, 50V, ±10% Axial
CX3228	22-6466	530 PF, 3KV, ±10% Disc
CX3229	22-7672-07	0.013 MF, 1.6KV, ±5% Polypropylene
C3233	22-7728	0.68 MF, 200V, ±10% Polyester
C3244	22-7566-24	0.1 MF, 250V, ±10% Polyester
C3261	22-7683-01	0.68 MF, 200V, ±5% Polypropylene
SEMICONDUCTORS		
CR3202	103-142-01	Diode, Low Voltage
CR3203	103-330A	Diode, Low Voltage
CRX3204	103-308A	Diode, Zener
CR3205	103-305	Diode, Damper
CR3206	103-284A	Diode, Low Voltage
CR3207	103-295-01A	Diode, Low Voltage (used with 149-454)
CR3208	103-295-01A	Diode, Low Voltage
CR3209	103-142-01	Diode, Low Voltage
CR3210	103-142-01	Diode, Low Voltage
CR3211	103-142-01	Diode, Low Voltage
QX3202	121-975	Transistor, NPN
QX3204	121-973	Transistor, PNP, Shutdown
Q3206	121-1037	Transistor, NPN, Forward Driver
QX3207	121-975	Transistor, NPN, Shutdown
Q3209	121-1040	Transistor, NPN, Reverse Driver

Ref. No.	Part No.	Description
TRANSFORMERS & COILS		
L3207	149-454	Core, Ferrite Bead
L3220	F-13834	Core & Sleeving Assy. (149-509-01)
LX3261	20-3976	Coil Width
LX3262	20-3975	Coil, Linearity, with 205-271 Hot Melt
T3205	95-3344	Transformer, Horizontal Driver
TX3204	95-3581-01	Transformer, Sweep
RESISTORS		
R2105	63-9921-94	8.2K Ohm, ±5% 1/4W Film
R2110	63-9921-64	470K Ohm, ±5% 1/4W Film
R2111	63-9919-83	3K Ohm, ±2% 1/4W Film
R2112	63-9919-96	10K Ohm, ±2% 1/4W Film
RX3204	63-9921-80	2.2K Ohm, ±5% 1/4W Film
RX3206	63-7805	3.3K Ohm, ±5% 1/2W Carbon
RX3207	63-9921-32	22 Ohm, ±5% 1/4W Film
RX3208	63-10235-80	2.2K Ohm, ±5% 1/4W Film
RX3209	63-10235-72	1K Ohm, ±5% 1/4W Film
RX3210	63-7805	3.3K Ohm, ±5% 1/2W Carbon
RX3211	63-10810-07	3K Ohm, ±1% 1/2W Film
RX3214	63-10233-81	2.4K Ohm, ±2% 1/4W Film
RX3216	63-10810-06	1.2K Ohm, ±1% 1/2W Film
RX3217	63-7760	270 Ohm, ±5% 1/2W Carbon
RX3215	63-10235-98	12K Ohm, ±5% 1/4W Film
RX3218	63-10235-82	2.7K Ohm, ±5% 1/4W Film
RX3219	63-10235-88	4.7K Ohm, ±5% 1/4W Film
R3224	63-9946-88	4.7K Ohm, ±5% 1/2W Film
R3225	63-10836-68	680 Ohm, ±5% 2W Wire Wound
R3226	63-10235-74	1.2K Ohm, ±5% 1/4W Film
R3227	63-10235-80	2.2K Ohm, ±5% 1/4W Film
RX3235	63-10810-06	1.2K Ohm, ±1% 1/2W Film
RX3240	53-10657-04	10 Meg Ohm, ±20% 1/2W Carbon
R3242	63-10243-80	2.2K Ohm, ±5% 1/2W Film
R3243	63-10243-80	2.2K Ohm, ±5% 1/2W Film
R3244	63-7868	100K Ohm, ±5% 1/2W Carbon
R3261	63-10444-86	390 Ohm, ±10% 5W Wire Wound
R3262	63-10565-65	510 Ohm, ±10% 1/2W Film
R3263	63-10565-65	510 Ohm, ±10% 1/2W Film
R3282	63-10235-96	10K Ohm, ±5% 1/4W Film



SCHEMATIC FOR
9-227-01
RGB COLOR MONITOR
(MAIN BOARD)

ZENITH RADIO CORP. CHICAGO, ILL	C	9-227

M051-00087-A024

ZENITH MONITOR — MAIN BOARD REPLACEMENT PARTS LIST

RESISTORS

Board 9-227	Board 9-227-01	Ref. No.	Part No.	Description
X	X	RX2101	63-10565-32	22 Ohm, ±5%, 1/2W Film
X	X	R2102	63-10243-56	220 Ohm, ±5%, 1/2W Film
X	X	R2103	63-10235-88	4.7K Ohm, ±5%, 1/2W Film
X	X	RX2104	63-10243-11	3 Ohm, ±5%, 1/2W Film
X	X	RX2105	63-10243-11	3 Ohm, ±5%, 1/2W Film
X	X	R2106	63-10235-72	1K Ohm, ±5%, 1/4W Film
X	X	R2107	63-10235-66	560 Ohm, ±5%, 1/4W Film
X	X	R2108	63-10235-66	560 Ohm, ±5%, 1/4W Film
X	X	R2109	63-10565	1 Ohm, ±5%, 1/2W Film
X	X	R2110	63-10565	1 Ohm, ±5%, 1/2W Film
X	X	R2111	63-10565	1 Ohm, ±5%, 1/2W Film
X	X	R2112	63-10565	1 Ohm, ±5%, 1/2W Film
X	X	R2113	63-10243-60	330 Ohm, ±5%, 1/2W Film
X	X	R2114	63-10235-72	1K Ohm, ±5%, 1/4W Film
X	X	R2115	63-10235-88	4.7K Ohm, ±5%, 1/4W Film
X	X	R2116	63-10235-60	330 Ohm, ±5%, 1/4W Film
X	X	R2117	63-10235-80	2.2K Ohm, ±5%, 1/4W Film
X	X	R2118	63-10235-88	4.7K Ohm, ±5%, 1/4W Film
X	X	R2119	63-10235-54	180 Ohm, ±5%, 1/4W Film
X	X	R2120	63-10565-08	2.2 Ohm, ±5%, 1/2W Film
X	X	R2121	63-10243-52	150 Ohm, ±5%, 1/2W Film
X	X	R2122	63-10243-52	150 Ohm, ±5%, 1/2W Film
X	X	R2125	63-9023-02	550 Ohm, ±20%, Control-Rotary Single-GRA
	X	R2126	63-10243-66	560 Ohm, ±5%, 1/2W Film
X		R2126	63-10243-53	160 Ohm, ±5%, 1/2W Film
	X	R2127	63-10243-69	750 Ohm, ±5%, 1W Carbon
X		R2128	63-10243-66	560 Ohm, ±5%, 1/2W Film
	X	R2128	63-6058	510 Ohm, ±5%, 1W Carbon
	X	R2129	63-10243-65	510 Ohm, ±5%, 1/2W Carbon
X		R2501	63-10236-28	220K Ohm, ±5%, 1/4W Film
	X	R2501	63-10236-52	2.2 Meg Ohm, ±5%, 1/4W Film
X	X	R2502	63-10235-90	5.6K Ohm, ±5%, 1/4W Film
X		R2503	63-10235-56	220 Ohm, ±5%, 1/4W Film
	X	R2503	63-10235-58	270 Ohm, ±5%, 1/4W Film
X		R2504	63-10235-80	2.2K Ohm, ±5%, 1/4W Film
	X	R2504	63-10235-69	750 Ohm, ±5%, 1/4W Film
X		R2505	63-10857-11	5K Ohm, Control-Rotary Single-RED
	X	R2505	63-10857-27	800 Ohm, Control-Rotary Single-Red Cut-Off
X		R2506	63-10857-30	1K Ohm, Control-Rotary Single-Yellow
	X	R2506	63-10857-27	800 Ohm, Control-Rotary Single-Red Drive
X		R2507	63-10235-76	1.5K Ohm, ±5%, 1/4W Film
	X	R2507	63-10235-75	1.3K Ohm, ±5%, 1/4W Film
	X	R2508	63-10235-93	7.5K Ohm, ±5%, 1/4W Film
X		R2508	63-10235-82	2.7K Ohm, ±5%, 1/4W Film
X		R2509	63-10235-80	2.2K Ohm, ±5%, 1/4W Film
X		R2510	63-10235-50	120 Ohm, ±5%, 1/4W Film
	X	R2510	63-10235-48	100 Ohm, ±5%, 1/4W Film
X		R2511	63-10235-74	1.2K Ohm, ±5%, 1/4W Film
	X	R2511	63-10235-67	620 Ohm, ±5%, 1/4W Film
X		R2512	63-10236-28	220K Ohm, ±5%, 1/4W Film
	X	R2512	63-10236-52	2.2 Meg Ohm, ±5%, 1/4W Film
X	X	R2513	63-10235-90	5.6K Ohm, ±5%, 1/4W Film
X		R2514	63-10235-56	220 Ohm, ±5%, 1/4W Film
	X	R2514	63-10235-58	270 Ohm, ±5%, 1/4W Film
X		R2515	63-10235-80	2.2K Ohm, ±5%, 1/4W Film
		R2515	63-10235-71	910 Ohm, ±5%, 1/4W Film
X		R2516	63-10857-32	5K Ohm, Control-Rotary Single-Green
	X	R2516	63-10857-25	800 Ohm, Control-Rotary Single-Green Cut-Off
X		R2517	63-10857-30	1K Ohm, Control-Rotary Single-Yellow
	X	R2517	63-10857-25	800 Ohm, Control-Rotary Single-Green Drive
X		R2518	63-10235-76	1.5K Ohm, ±5%, 1/4W Film

RESISTORS (Continued)

Board 9-227	Board 9-227-01	Ref. No.	Part No.	Description
	X	R2518	63-10235-73	1.1K Ohm, ±5%, 1/4W Film
X		R2519	63-10235-93	7.5K Ohm, ±5%, 1/4W Film
	X	R2519	63-10235-82	2.7K Ohm, ±5%, 1/4W Film
X		R2520	63-10235-80	2.2K Ohm, ±5%, 1/4W Film
X		R2521	63-10235-50	120 Ohm, ±5%, 1/4W Film
	X	R2521	63-10235-48	100 Ohm, ±5%, 1/4W Film
X		R2522	63-10235-74	1.2K Ohm, ±5%, 1/4W Film
X		R2523	63-10236-28	220K Ohm, ±5%, 1/4W Film
	X	R2523	63-10236-52	2.2 Meg Ohm, ±5%, 1/4W Film
X	X	R2524	63-10235-90	5.6K Ohm, ±5%, 1/4W Film
X		R2525	63-10235-56	220 Ohm, ±5%, 1/4W Film
	X	R2525	63-10235-58	270 Ohm, ±5%, 1/4W Film
X		R2526	63-10235-80	2.2K Ohm, ±5%, 1/4W Film
	X	R2526	63-10235-69	750 Ohm, ±5%, 1/4W Film
X		R2527	63-10857-31	5K Ohm, Control-Rotary Single-Blue
	X	R2527	63-10857-26	800 Ohm, Control-Rotary Single-Blue Cut-Off
X		R2528	63-10857-30	1K Ohm, Control-Rotary Single-Yellow
	X	R2528	63-10857-26	800 Ohm, Control-Rotary Single-Blue Drive
X		R2529	63-10235-76	1.5K Ohm, ±5%, 1/4W Film
	X	R2529	63-10235-75	1.3K Ohm, ±5%, 1/4W Film
X		R2530	63-10235-93	7.5K Ohm, ±5%, 1/4W Film
	X	R2530	63-10235-82	2.7K Ohm, ±5%, 1/4W Film
X		R2531	63-10235-80	2.2K Ohm, ±5%, 1/4W Film
X		R2532	63-10235-50	120 Ohm, ±5%, 1/4W Film
	X	R2532	63-10235-48	100 Ohm, ±5%, 1/4W Film
X		R2533	63-10235-74	1.2K Ohm, ±5%, 1/4W Film
		R2534	63-10235-52	150 Ohm, ±5%, 1/4W Film
X		R2535	63-10235-52	150 Ohm, ±5%, 1/4W Film
X		R2536	63-10235-52	150 Ohm, ±5%, 1/4W Film
X		R2537	63-10235-52	150 Ohm, ±5%, 1/4W Film
X		R2538	63-10235-56	220 Ohm, ±5%, 1/4W Film
	X	R2538	63-10235-48	100 Ohm, ±5%, 1/4W Film
X		R2539	63-10235-56	220 Ohm, ±5%, 1/4W Film
	X	R2539	63-10235-48	100 Ohm, ±5%, 1/4W Film
X		R2540	63-10235-56	220 Ohm, ±5%, 1/4W Film
	X	R2540	63-10235-48	100 Ohm, ±5%, 1/4W Film
	X	R2541	63-10235-54	180 Ohm, ±5%, 1/4W Film
	X	R2542	63-10235-53	160 Ohm, ±5%, 1/4W Film
	X	R2543	63-10235-54	180 Ohm, ±5%, 1/4W Film
	X	R2544	63-10235-54	180 Ohm, ±5%, 1/4W Film
	X	R2545	63-10235-54	180 Ohm, ±5%, 1/4W Film
	X	R2546	63-10235-53	160 Ohm, ±5%, 1/4W Film
	X	R2548	63-10235-67	620 Ohm, ±5%, 1/4W Film
	X	R2549	63-10235-67	620 Ohm, ±5%, 1/4W Film
	X	R2550	63-10235-32	22 Ohm, ±5%, 1/4W Film
	X	R2552	63-10235-32	22 Ohm, ±5%, 1/4W Film
	X	R2554	63-10235-32	22 Ohm, ±5%, 1/4W Film
X	X	R3201	63-10235-59	300 Ohm, ±5%, 1/4W Film
X	X	R3202	63-10235-44	68 Ohm, ±5%, 1/4W Film
X	X	R3203	63-10235-52	150 Ohm, ±5%, 1/4W Film
X	X	R3205	63-7781	820 Ohm, ±5%, 1/2W Carbon
X		R3206	F-11851	12 Ohm, ±10%, 10W Resistor & Splice Assy.
	X	R3206	63-10460-50	12 Ohm, ±10%, 10W Wirewound
X	X	R3210	63-10420-31	2 Ohm, ±5%, 2W Wirewound
X	X	R3212	63-10235-76	1.5K Ohm, ±5%, 1/4W Film
X		R3213	63-10235-83	3K Ohm, ±5%, 1/4W Film
	X	R3213	63-10235-86	3.9K Ohm, ±5%, 1/4W Film
X	X	R3214	63-10235-74	1.2K Ohm, ±5%, 1/4W Film
X		R3215	63-10244-38	560K Ohm, ±5%, 1/2W Film
	X	R3215	63-10244-40	680K Ohm, ±5%, 1/2W Film
X	X	R3216	63-10244-25	160K Ohm, ±5%, 1/2W Film
X	X	R3217	63-10244-33	360K Ohm, ±5%, 1/2W Film
X	X	R3218	63-10235-80	2.2K Ohm, ±5%, 1/4W Film
	X	R3219	63-10244-38	560K Ohm, ±5%, 1/2W Film

MAIN BOARD (Continued)

RESISTORS (Continued)

Board 9-227	Board 9-227-01	Ref. No.	Part No.	Description
X	X	R3222	63-10235-40	47 Ohm, ±5%, 1/4W Film
X	X	R3231	63-9982	1 Ohm, ±10%, 2W Wirewound
X	X	R3233	63-10565-14	3.9 Ohm, ±5%, 1/2W Film
X	X	R3234	63-10565-14	3.9 Ohm, ±5%, 1/2W Film
X	X	R3239	63-10244-20	100K Ohm, ±5%, 1/2W Film
X	X	R3241	63-8246	4 Ohm, 10W Wirewound
X	X	R3244	63-10840-40	47 Ohm, ±5%, 3W Film, Tin Oxide
X	X	R3245	63-10710A	Thermistor
X	X	RX3246	63-10657-03	1.2 Meg Ohm, ±20%, 1/2W Carbon
	X	R3260	63-10243-96	10K Ohm, ±5%, 1/2W Film
	X	R3261	63-10244-24	150K Ohm, ±5%, 1/4W Film
	X	R3262	63-10235-68	680 Ohm, ±5%, 1/4W Film
X	X	R3401	63-10236-46	1.2 Meg Ohm, ±5%, 1/4W Film
X	X	R3402	63-10236-22	120K Ohm, ±5%, 1/4W Film
X	X	R3403	63-10235-86	3.9K Ohm, ±5%, 1/4W Film
X	X	R3404	63-10235-86	3.9K Ohm, ±5%, 1/4W Film
X	X	R3405	63-10236-08	33K Ohm, ±5%, 1/4W Film
X	X	R3406	63-10235-68	680 Ohm, ±5%, 1/4W Film
X	X	R3407	63-10236-18	82K Ohm, ±5%, 1/4W Film
X	X	R3408	63-10236-04	22K Ohm, ±5%, 1/4W Film
X	X	R3409	63-10857-17	100K Ohm, Control-Rotary Single-Green
X	X	R3410	63-10236-31	300K Ohm, ±5%, 1/4W Film
X	X	R3411	63-10236-03	20K Ohm, ±5%, 1/4W Film
X	X	R3412	63-10236-13	51K Ohm, ±5%, 1/4W Film
X	X	R3413	63-10236-07	30K Ohm, ±5%, 1/4W Film
X	X	R3414	63-10235-98	12K Ohm, ±5%, 1/4W Film
X	X	R3415	63-10236-02	18K Ohm, ±5%, 1/4W Film
X	X	R3417	63-10243-60	330 Ohm, ±5%, 1/2W Film
X	X	R3418	63-10857-08	2K Ohm, Control-Rotary Single-Yellow
X	X	R3419	63-10235-84	3.3K Ohm, ±5%, 1/4W Film
X	X	R3420	63-10236-10	39K Ohm, ±5%, 1/4W Film
X	X	R3421	63-10235-73	1.1K Ohm, ±5%, 1/4W Film
X	X	R3422	63-10243-60	330 Ohm, ±5%, 1/2W Film
X	X	R3423	63-10243-60	330 Ohm, ±5%, 1/2W Film
X	X	R3424	63-10235-72	1K Ohm, ±5%, 1/4W Film
X	X	R3425	63-10235-88	4.7K Ohm, ±5%, 1/4W Film
X	X	R3428	63-10235-82	2.7K Ohm, ±5%, 1/4W Film
X	X	R3429	63-10235-76	1.5K Ohm, ±5%, 1/4W Film
X	X	R3431	63-10235-80	2.2K Ohm, ±5%, 1/4W Film
X		R3432	63-10235-55	200 Ohm, ±5%, 1/4W Film
	X	R3432	63-10235-79	2K Ohm, ±5%, 1/4W Film
X	X	R3433	63-10236-20	100K Ohm, ±5%, 1/4W Film
X	X	R3434	63-10236-22	120K Ohm, ±5%, 1/4W Film
X	X	R3435	63-10235-63	430 Ohm, ±5%, 1/4W Film
X	X	R3436	63-10235-72	1K Ohm, ±5%, 1/4W Film
X	X	R3439	63-10243-79	2K Ohm, ±5%, 1/2W Film
X	X	R3440	63-10235-86	3.9K Ohm, ±5%, 1/4W Film
X		R3441	63-10857	100 Ohm, Control-Rotary Single-Horizontal Center
	X	R3441	63-10857-02	250 Ohm, Control-Rotary Single-Horizontal Center
X	X	R3442	63-10235-86	3.9K Ohm, ±5%, 1/4W Film
X		R3443	63-10235-65	510 Ohm, ±5%, 1/4W Film
	X	R3443	63-10235-80	2.2K Ohm, ±5%, 1/4W Film
X	X	R3444	63-10235-60	330 Ohm, ±5%, 1/4W Film
X	X	R3445	63-10235-80	2.2K Ohm, ±5%, 1/4W Film
	X	R3446	63-10235-72	1K Ohm, ±5%, 1/4W Film
X		R3449	63-10235-76	1.5K Ohm, ±5%, 1/4W Film
X		R3451	63-10235-82	2.7K Ohm, ±5%, 1/4W Film
	X	R3451	63-10235-88	4.7K Ohm, ±5%, 1/4W Film
X	X	R3452	63-10235-92	6.8K Ohm, ±5%, 1/4W Film
	X	R3453	63-10235-75	1.3K Ohm, ±5%, 1/4W Film
X	X	R3461	63-10236	15K Ohm, ±5%, 1/4W Film
X	X	R3462	63-10236-13	51K Ohm, ±5%, 1/4W Film

CAPACITORS

Ref. No.	Part No.	Description
C2101	22-7775-10A	0.0068 MF, 100V ±20% Polyester
C2102	22-7775-24A	0.1 MF, 100V ±20% Polyester
C2103	22-7709-09C	100 MF, 35V +50%−10% Electrolytic
C2104	22-7613-24D	0.01 MF, 50V ±10% Disc
C2105	22-7390-02	0.47 MF, 50V ±20% Electrolytic
C2106	22-7710-07C	33 MF, 50V +50%−10% Electrolytic
C2107	22-7615-03D	0.0033 MF, 50V +80%−10% Disc
C2110	22-7742-10	0.001 MF, 50V ±10% Polyester
C2111	22-7774-17A	0.027 MF, 100V ±10% Polyester
C2176	22-7725	680 MF, 50V +100%−10% Electrolytic
C2501	22-7621-42C	220 PF, 50V ±5% Disc
C2502	22-7621-42C	220 PF, 50V ±5% Disc
C2503	22-7621-42C	220 PF, 50V ±5% Disc
C3201	22-7775-24A	0.1 MF, 100V ±20% Polyester
C3204	22-7603	4.7 MF, 315V +100%−10% Electrolytic
C3205	22-3512	0.01 MF, 1KV +40%−20% Disc
C3206	22-7603-01A	10 MF, 315V +100%−10% Electrolytic
C3207	22-7742-10	0.001 MF, 50V ±10% Axial
C3208	22-7742-10	0.001 MF, 50V ±10% Axial
C3209	22-7395	470 PF, 500V ±5% Disc
C3234	22-7395	470 PF, 500V ±5% Disc
C3236	22-7861-14	2200 MF, 35V ±20% Electrolytic
C3246	22-7603-01A	10 MF, 315V +100%−10% Electrolytic
C3247	22-7860-12	470 MF, 25V ±20% Electrolytic
C3249	22-7431-06	0.0047 MF, ±20% Disc
CX3250	22-7431-06	0.0047 MF, ±20% Disc
C3251	22-7811	0.001 MF, 1KV ±10% Disc
C3252	22-7811	0.001 MF, 1KV ±10% Disc
C3253	22-7811	0.001 MF, 1KV ±10% Disc
C3254	22-7404-06	22 MF, 16V ±20% Electrolytic
C3256	22-7508-05B	2200 MF, 35V +50%−10% Electrolytic
C3257	22-7395	470 PF, 500V ±5% Disc
C3401	22-7613-24D	0.01 MF, 50V ±10% Disc
C3402	22-7406-01	1.0 MF, 35V ±20% Electrolytic
C3403	22-7773-18A	0.033 MF, 100V ±5% Polyester
C3404	22-7773-17A	0.027 MF, 100V ±5% Polyester
C3405	22-7775-10A	0.0068 MF, 100V ±20% Polyester
C3407	22-7710-01A	1.0 MF, 50V +50%−10% Electrolytic
C3409	22-7709-09C	100 MF, 35V +100%−10% Electrolytic
C3410	22-7404-06A	22 MF, 16V ±20% Electrolytic NP
C3411	22-7708-09	100 MF, 25V +50%−10% Electrolytic
C3412	22-7710-01C	1.0 MF, 50V +50%−10% Electrolytic
C3413	22-7562-32	0.47 MF, 100V ±5% Polyester
C3414	22-7774-16A	0.022 MF, 100V ±10% Polyester
C3419	22-7751-39	180 PF, 50V ±5% Axial
C3420	22-7710-01C	1.0 MF, 50V +50%−10% Electrolytic
C3421	22-7773-18B	0.033 MF, 100V ±5% Polyester
C3422	22-7613-24D	0.01 MF, 50V ±10% Disc
C3423	22-7613-08D	470 PF, 50V ±10% Disc
C3424	22-7742-05	390 PF, 50V ±10% Axial
C3425	22-7742-10	0.001 MF, 50V ±10% Axial
C3426	22-7742-10	0.01 MF, 50V ±10% Axial
C3427	22-7647-35C	150 PF, ±10% Axial
C3428	22-7774-12	0.01 MF, 100V ±10% Polyester
C3428 (on-01 version)	22-7774-20A	0.047 MF, 100V ±10% Polyester
C3429	22-7405-04	4.7 MF, 25V ±20% Electrolytic NP
C3429 (on-01 version)	22-7406	0.47 MF, 35V ±20% Electrolytic NP
C3430	22-7613-24D	0.01 MF, 50V ±10% Disc
C3431	22-7774-16A	0.022 MF, 100V ±10% Polyester
C3434	22-7742-06	470 PF, 50V ±10% Axial
C3436	22-7613-24C	0.01 MF, 100V ±10% Disc
C3450	22-7739-29A	0.27 MF, 100V ±10% Polyester
C3450 (on-01 version)	22-7619-41C	200 PF, 50V ±5% Disc
C3461	22-7710-01C	1.0 MF, 50V +50%−10% Electrolytic
C3462	22-7710-01C	1.0 MF, 50V +50%−10% Electrolytic
C3462 (on-01 version)	22-7739-09	0.0056 MF, 100V ±10% Polyester
C3463	22-7508	47 MF, 35V ±20% Electrolytic

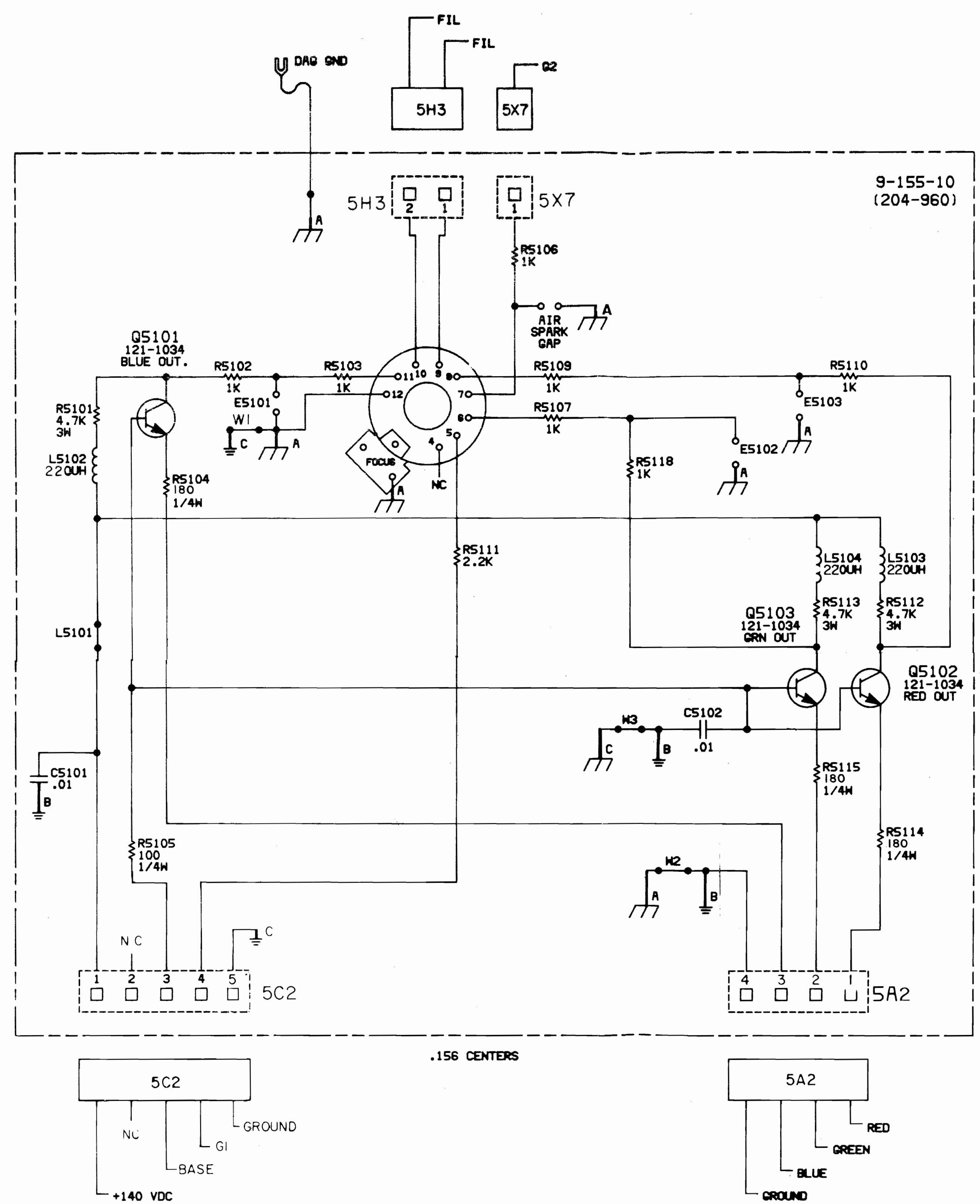
MAIN BOARD (Continued)

Ref. No.	Part No.	Description
	SEMICONDUCTORS	
CR2104	103-142-01	Diode, Low Voltage
CR2105	103-254-01	Diode, Low Voltage
CR2106	103-254-01	Diode, Low Voltage
CR2107	103-254-01	Diode, Low Voltage
CR2501	103-142-01	Diode, Low Voltage
CR2502	103-142-01	Diode, Low Voltage
CR2503	103-142-01	Diode, Low Voltage
CR3202	103-330A	Diode, Low Voltage
CR3205	103-309-01	Diode, Zener 10V 1W
CR3206	103-254-01	Diode, Low Voltage
CR3208	103-326A	Diode, Low Voltage
CR3210	103-254-01	Diode, Low Voltage
CR3211	103-254-01	Diode, Low Voltage
CR3214	103-284-A	Diode, Low Voltage
CR3217	103-326A	Diode, Low Voltage
CR3219	103-330A	Diode, Low Voltage
CR3223	103-330A	Diode, Low Voltage
CR3224	103-330A	Diode, Low Voltage
CR3231	103-315-06A	Diode
CR3232	103-315-06A	Diode
CR3233	103-315-06A	Diode
CR3234	103-315-06A	Diode
CR3235	103-284A	Diode, Low Voltage
CR3401	103-142-01	Diode, Low Voltage
CR3404	103-143-01	Diode, Low Voltage
CR3405	103-142-01	Diode, Low Voltage
CR3406	103-142-01	Diode, Low Voltage
CR3408	103-279-14	Diode, Zener 6.8V 1/2W
Q2101	F-10896	Transistor & Heat Sink Assy.
Q2102	F-10896	Transistor & Heat Sink Assy.
Q2103	121-975	Transistor NPN
Q2104	121-1064	Transistor PNP
Q2501	121-1019	Transistor PNP
Q2502	121-895	Transistor NPN
Q2502 (on-01 version)	121-551	Transistor NPN
Q2503	121-1019	Transistor PNP
Q2504	121-895	Transistor NPN
Q2504 (on-01 version)	121-551	Transistor NPN
Q2505	121-1019	Transistor PNP
Q2506	121-895	Transistor NPN
Q2506 (on-01 version)	121-551	Transistor NPN
Q2507	121-1019	Transistor
Q2508	121-1019	Transistor
Q2509	121-1019	Transistor
Q3200	F-12737	Transistor & Heat Sink Assy.
Q3201	121-499-01	Transistor NPN Regular Feed Back
Q3202	121-1034	Transistor NPN
Q3203	121-1059	Transistor PNP
Q3401	121-895	Transistor NPN
Q3402	121-986	Transistor PNP
Q3403	121-985	Transistor NPN
Q3404	121-895	Transistor NPN
Q3405	121-895	Transistor NPN
	TRANSFORMERS & COILS	
L2502	20-3887-01	Coil Peaking 1.2 UH
L2503	20-3887-01	Coil Peaking 1.2 UH
L2504	20-3887-01	Coil Peaking 1.2 UH
L3201	20-2021	Coil Peaking 100 UH
LX3202	95-3501-01	Transformer Choke 60 UH
L3401	20-3831	Coil Peaking 663 UH
L3402	20-3998	Coil Peaking 39 UH
L3402 (on-01 version)	20-4026	Coil Turnable 39 UH

ZENITH MONITOR — CRT SOCKET BOARD REPLACEMENT PARTS LIST

CRT SOCKET (9-155-10)

Ref. No.	Part No.	Description
	CAPACITORS	
C5101	22-4671	0.01 MF, 1.5KV, +80%–20% Disc
C5102	22-3512	0.01 MF, 1KV, +40%–10% Disc
	TRANSFORMERS & COILS	
L5102	20-3887-28E	220 MH Peaking
L5103	20-3887-28E	220 MH Peaking
L5104	20-3887-28E	220 MH Peaking
	SEMICONDUCTORS	
Q5101	F7510	Transistor, NPN, Video Out, Blue
Q5102	F7510	Transistor, NPN, Video Out, Red
Q5103	F7510	Transistor, NPN, Video Out, Green
	RESISTORS	
R5101	63-10840-88	4.7K Ohm, ±5%, 3W Film
R5102	63-7785	1K Ohm, ±10%, 1/2W Carbon
R5103	63-7785	1K Ohm, ±10%, 1/2W Carbon
R5104	63-10235-54	180 Ohm, ±5%, 1/4W Film
R5105	63-10235-48	100 Ohm, ±5%, 1/4W Film
R5106	63-7785	1K Ohm, ±10%, 1/2W Carbon
R5107	63-7785	1K Ohm, ±10%, 1/2W Carbon
R5108	63-7785	1K Ohm, ±10%, 1/2W Carbon
R5109	63-7785	1K Ohm, ±10%, 1/2W Carbon
R5110	63-7785	1K Ohm, ±10%, 1/2W Carbon
R5111	63-7799	2.2K Ohm, ±10%, 1/2W Carbon
R5112	63-10840-88	4.7K Ohm, ±5%, 3W Carbon
R5113	63-10840-88	4.7K Ohm, ±5%, 3W Carbon
R5114	63-10235-54	180 Ohm, ±5%, 1/4W Film
R5115	63-10235-54	180 Ohm, ±5%, 1/4W Film
	MISCELLANEOUS	
5A2	86-799	Stake Connector 4/.156
5C2	86-799	Stake Connector4/.156
5H3	86-799	Stake Connector 2/.156
5X7	86-799	Stake Connector 1/.312
	A-10008	CRT Socket

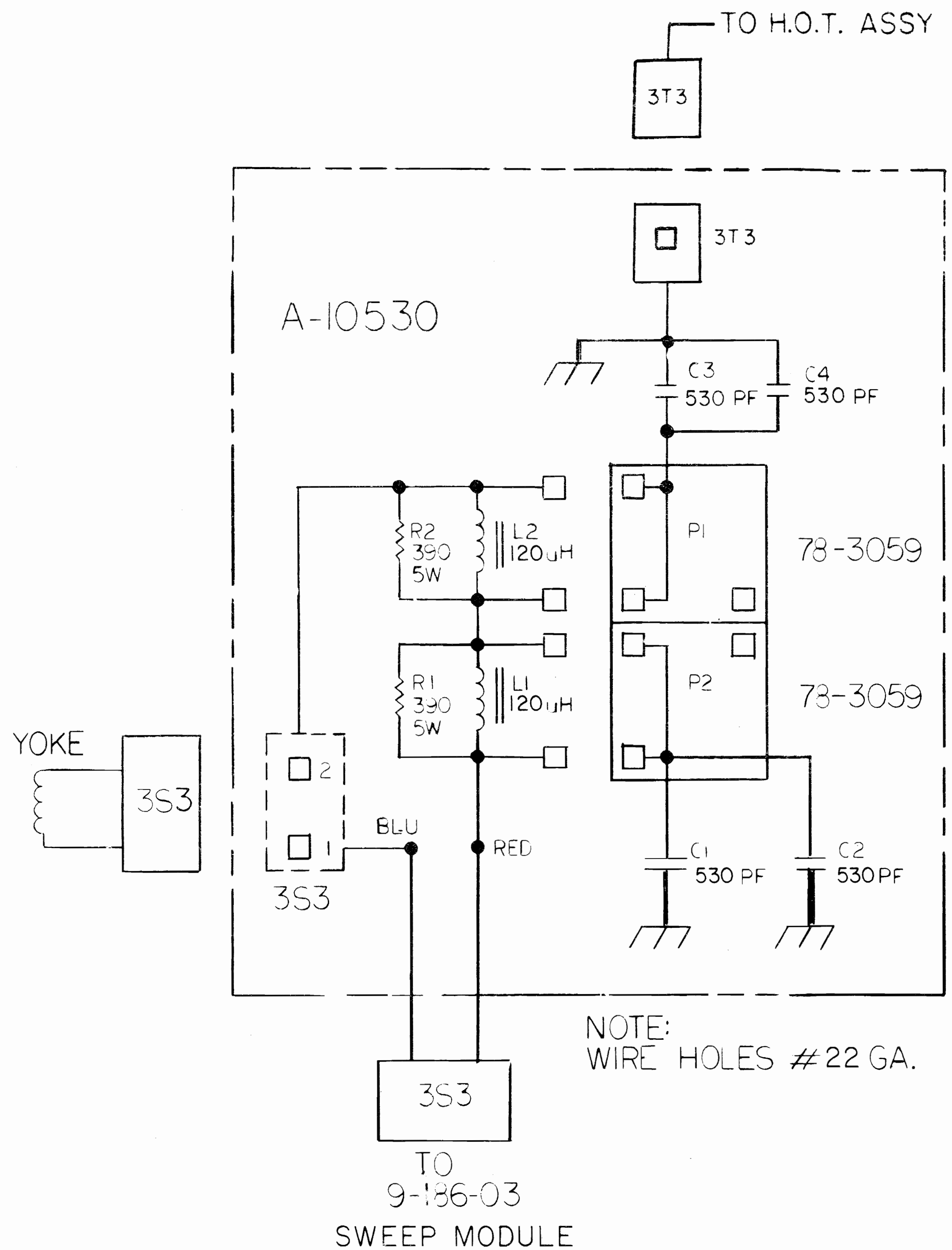


NOTE:
1. ALL RESISTORS ARE 1/2WATT UNLESS OTHERWISE SPECIFIED.

NOTES: (USED WITH CIRCUIT REFERENCE DESIGNATORS)
A. P/L = SEE PARTS LIST FOR APPLICABLE USAGE.
B. —●——●— = JUMPER WIRE USED INSTEAD.
C. —● ■ ●— = PROVISION ON PRINTED CIRCUIT BOARD.

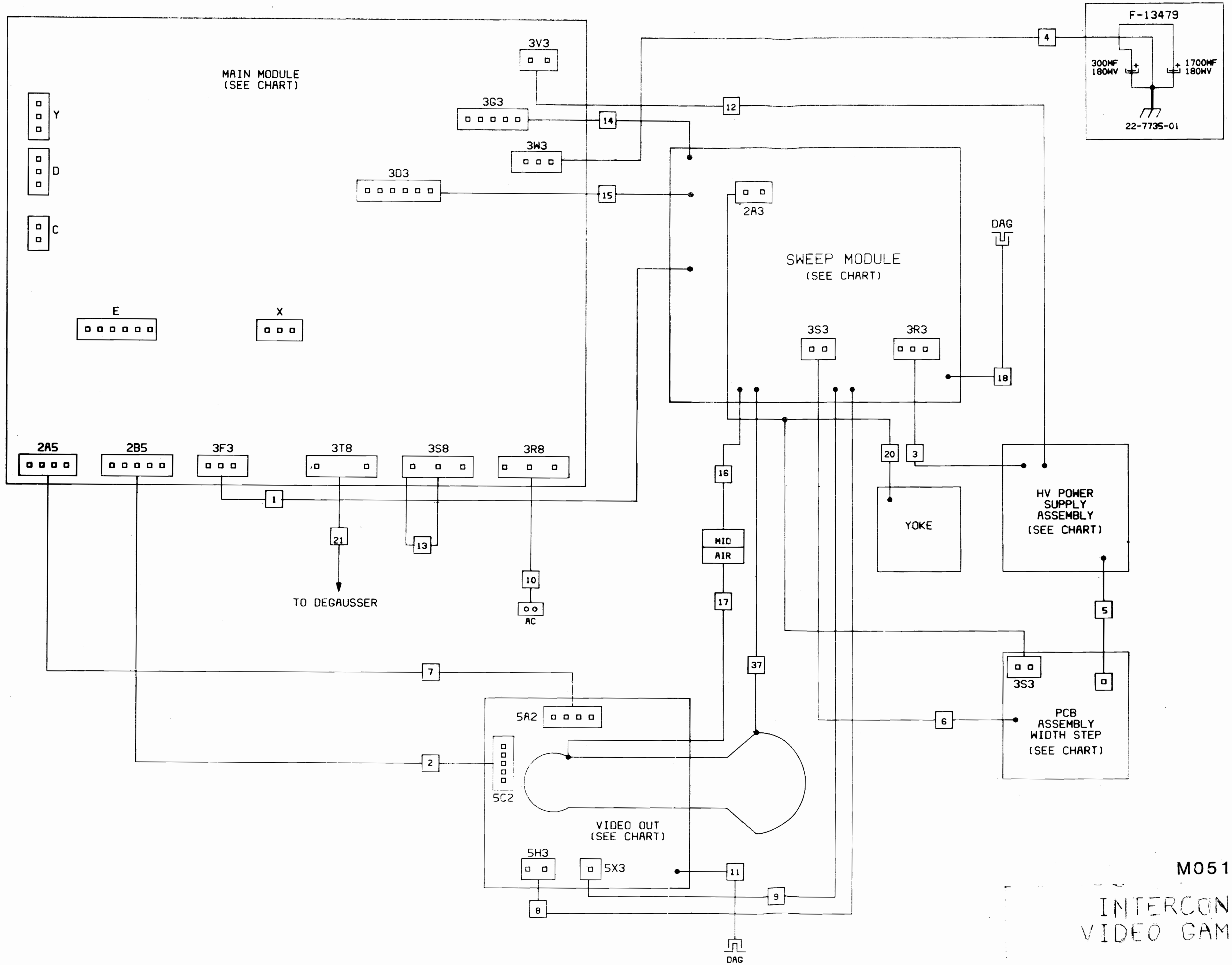
M051-00087-A022

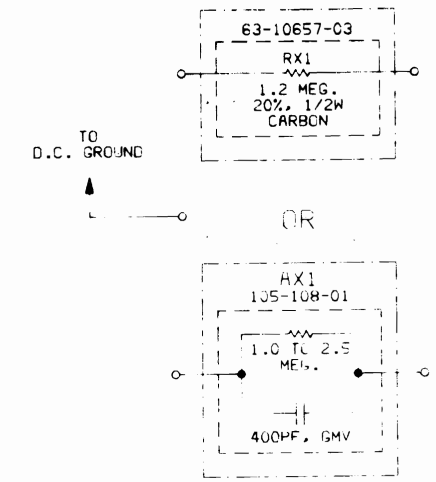
SCHEMATIC FOR 9-155-10 RGB COLOR MONITOR CRT SOCKET BOARD		
ZENITH RADIO CORP. CHICAGO, ILL.	ISSUE	9-155



M051-00087-A023

SCHEMATIC FOR A-10530 WIDTH STEP ASSY.		
ZENITH RADIO CORP. CHICAGO, ILL.	ISSUE B	A-10530





IMPORTANT SAFETY NOTICE

WHEN SERVICING THIS CHASSIS, UNDER NO CIRCUMSTANCES SHOULD THE ORIGINAL DESIGN BE MODIFIED OR ALTERED WITHOUT PERMISSION FROM THE ZENITH RADIO CORPORATION. ALL COMPONENTS SHOULD BE REPLACED ONLY WITH TYPES IDENTICAL TO THOSE IN THE ORIGINAL CIRCUIT, AND THEIR PHYSICAL LOCATION, WIRING AND LEAD DRESS MUST CONFORM TO ORIGINAL LAYOUT UPON COMPLETION OF REPAIRS.

SPECIAL CIRCUITS ARE ALSO USED TO PREVENT SHOCK AND FIRE HAZARD. THESE AREAS ARE SHADED ON THE SCHEMATIC FOR EASY IDENTIFICATION. THE LETTER "X" INCLUDED IN THE ITEM NUMBER DESIGNATES SPECIAL FAILSAFE COMPONENTS IN THESE AREAS WHICH ARE REQUIRED TO MAINTAIN SAFE PERFORMANCE. NO DEVIATIONS ARE ALLOWED WITHOUT PRIOR APPROVAL BY THE PRODUCT SAFETY ENGINEERING DEPARTMENT.

THIS CIRCUIT DIAGRAM MAY OCCASIONALLY DIFFER FROM THE ACTUAL CIRCUIT USED. THIS WAY, IMPLEMENTATION OF THE LATEST SAFETY AND PERFORMANCE IMPROVEMENT CHANGES INTO THE SET IS NOT DELAYED UNTIL THE NEW SERVICE LITERATURE IS PRINTED.

M051-00087-A025

INTERCONNECT FOR VIDEO GAME MONITOR

ZENITH RADIO CORP.
CHICAGO, ILL.

ISSUE

VII. Coin Door Maintenance

SPECIAL NOTE: If you have any questions about the coin acceptors in your game(s), please feel free to contact their manufacturers. Each manufacturer's name is **PROMINENTLY** imprinted on every acceptor mechanism.

Metal mechanisms only:

COIN MECHANISMS, INC.
817 Industrial Drive
Elmhurst, IL 60126
Phone (312) 279-9150

Metal and Plastic mechanisms:

COINCO COIN ACCEPTORS, INC.
860 Eagle Drive
Bensenville, IL 60106
Phone (312) 766-6781

COIN DOOR MAINTENANCE

METAL COIN ACCEPTOR MECHANISMS

Periodically, the metal coin acceptor mechanism(s) must be removed from the coin door and cleaned.

1. **Make sure the power to the game is off.**
2. Unlock and open the coin door.
3. Remove the coin acceptor mechanism as shown in Figure 5-1.
   - ☐ Push down on the two spring loaded latches.
   - ☐ While holding the latches down, pull the top of the coin acceptor mechanism toward you.
   - ☐ Release the latches and lift out the coin acceptor mechanism.

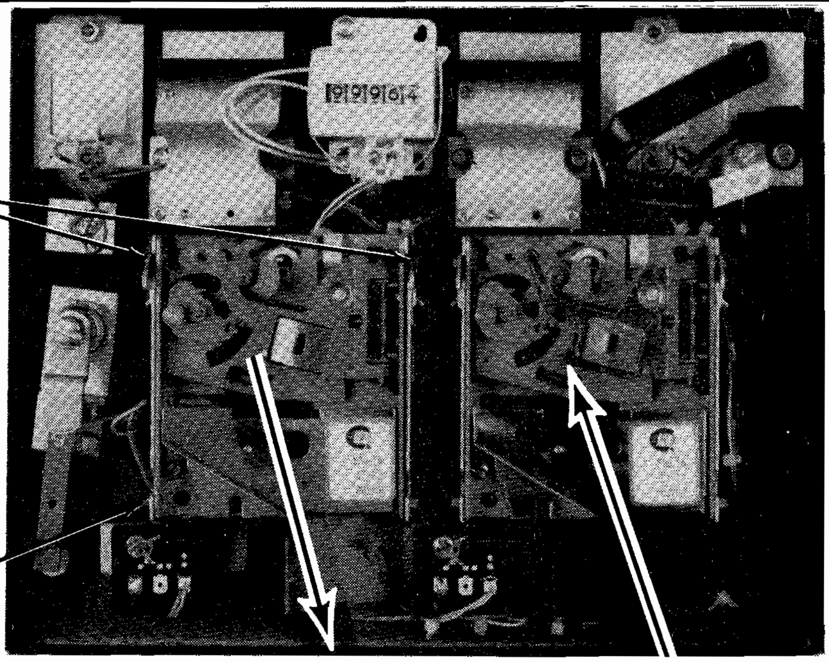


Figure 5-1 Removing and Replacing the Coin Acceptor

4. Clean the magnet of all foreign particles. See Figure 5-2.
   - ☐ This may be accomplished by swinging the gate open as shown in the above figure.
5. Remove the cradles and undersize levers and clean the bushings. (A pipe cleaner makes a good bushing cleaner.)
   - ☐ Also clean the pivot pin.
6. Whenever needed, the coin acceptor should be cleaned with hot water and cleanser in the following manner:
   - ☐ Place the coin acceptor in boiling water for about ten minutes.

CAUTION: BE CAREFUL NOT TO BURN YOURSELF.

- ☐ Next, use a brush and kitchen cleaner to remove all remaining foreign matter from the unit.
- ☐ Rinse the coin acceptor in clean boiling water.
- ☐ Dry the coin acceptor thoroughly by using filtered compressed air to blow it dry.

NOTE: The reason we recommend using boiling water is that it evaporates faster than cold water and speeds drying time.

7. To lubricate the coin acceptor:
   - ☐ Use **ONLY** powdered graphite and put it **ONLY** on the moving parts of the coin acceptor. These parts are called out in Figure 5-3.
   - ☐ Be extremely careful to keep the powdered graphite away from paths that are traveled by the coins.

— WARNING —
DO NOT USE OIL TO LUBRICATE THE COIN ACCEPTOR.

8. Check the coin chute for obstructions such as: paper, gum, etc.
9. Reinstall the coin acceptor to the coin door. See Figure 5-1.
   - ☐ Place the two pegs at the coin acceptor's base into their retaining slots.
   - ☐ Now push the top of the coin acceptor toward the coin door until it snaps in place and is held there by the two spring loaded latches.
10. Close and lock the coin door.

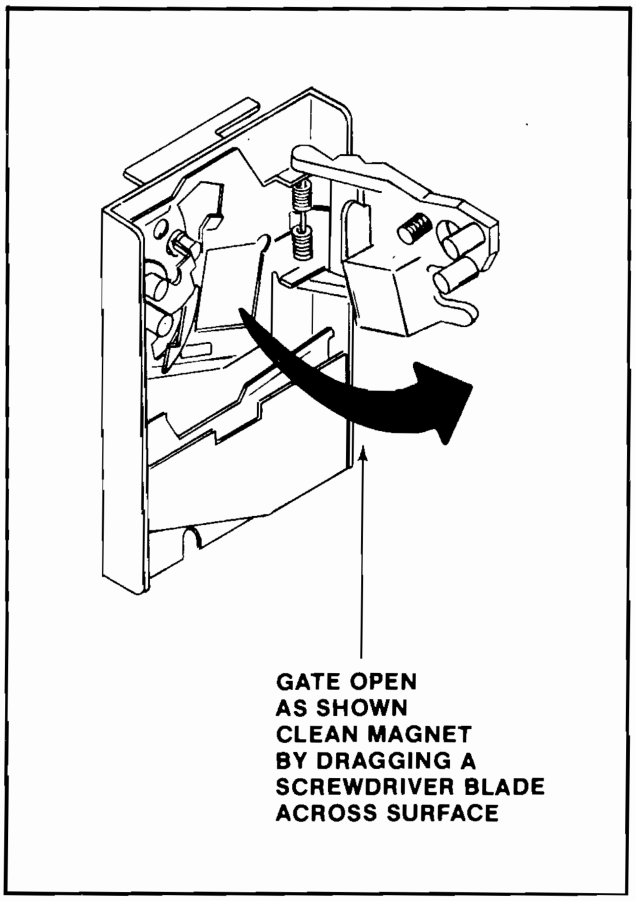


Figure 5-2 Cleaning the Metal Coin Acceptor

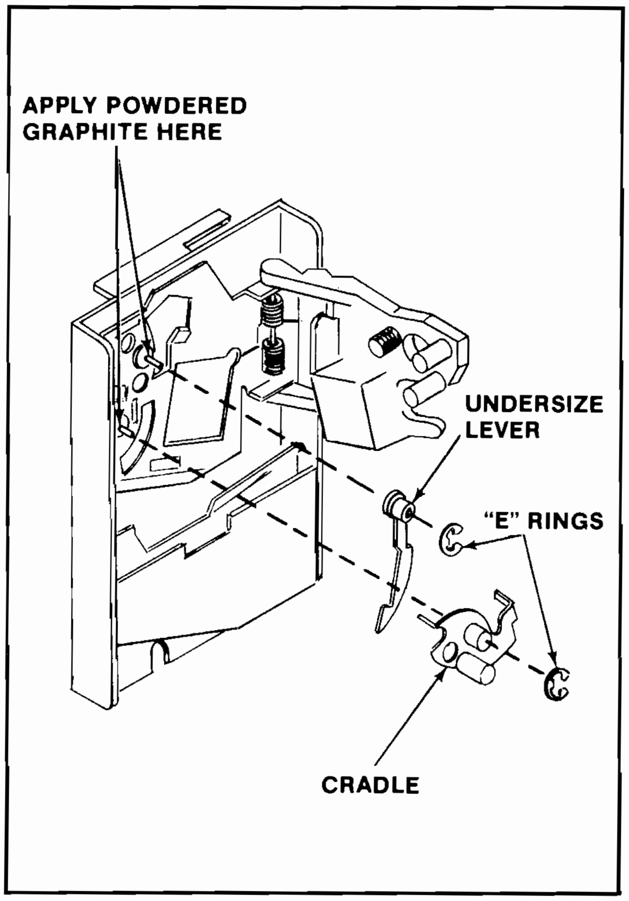


Figure 5-3 Lubricating the Metal Coin Acceptor

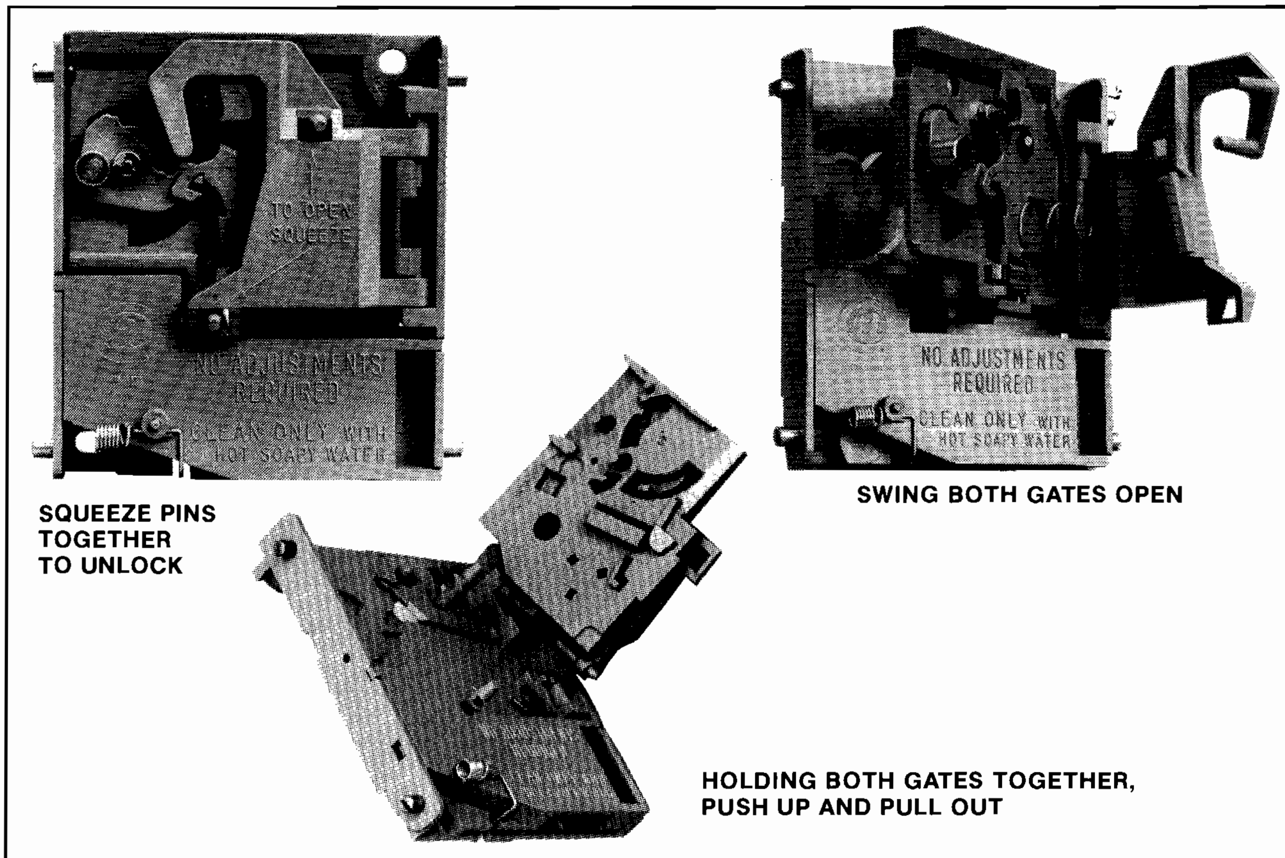


Figure 5-4 Opening the Plastic Coin Acceptor

PLASTIC COIN ACCEPTOR MECHANISMS

The plastic coin acceptor mechanism(s) must be removed periodically from the coin door and cleaned.

1. **Make sure the power to the game is off.**
2. Unlock and open the coin door.
3. Remove the coin acceptor mechanisms(s) as shown in Figure 5-1.
   - ☐ Push down on the two spring loaded latches.
   - ☐ While holding the latches down, pull the top of the acceptor mechanism toward you.
   - ☐ Release the latches and lift out the mechanism.
4. Squeeze the two pins indicated in Figure 5-4 together to open the mechanism and break it down into its three basic parts.
   - ☐ Clean the mechanism in hot soapy water. It never rusts.
   - ☐ Rinse the mechanism in clean hot water and allow it to dry.
   - ☐ Reassemble the mechanism (it never needs lubrication).
5. Check the coin chute for obstructions such as: paper, gum, etc.
6. Reinstall the coin acceptor to the coin door. See Figure 5-5.
   - ☐ Place the two pegs at the coin acceptor's base into their retaining slots.
   - ☐ Now push the top of the coin acceptor toward the coin door until it snaps in place and is held there by the two spring loaded latches.
7. Close and lock the coin door.

NOTE: See Figure 5-6 for instructions on how to set the plastic coin acceptor mechanisms to either accept or reject Canadian quarters.

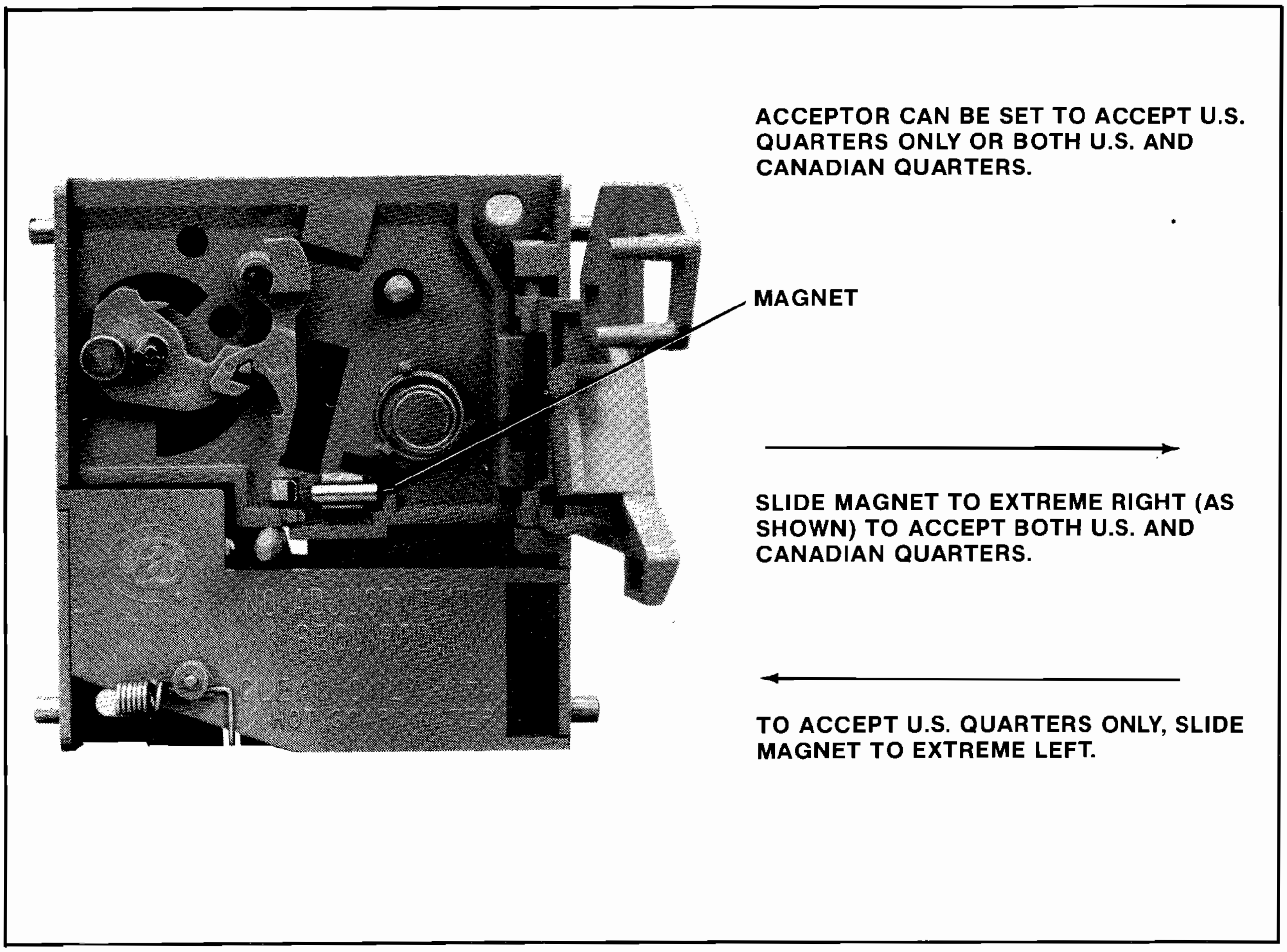
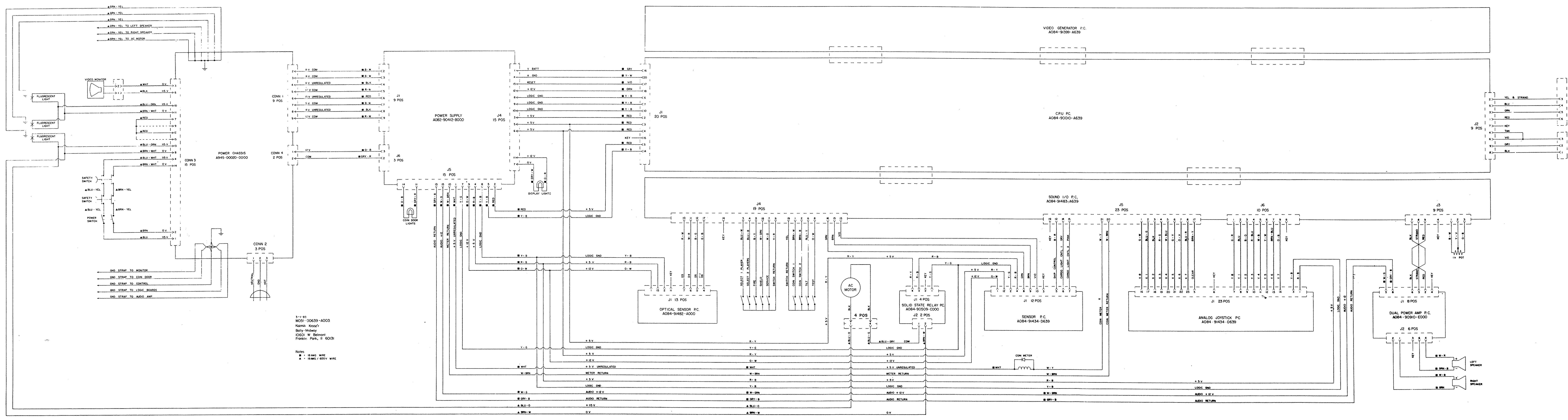


Figure 5-5 Changing the Plastic Coin Acceptor to Accept American or Canadian Quarters

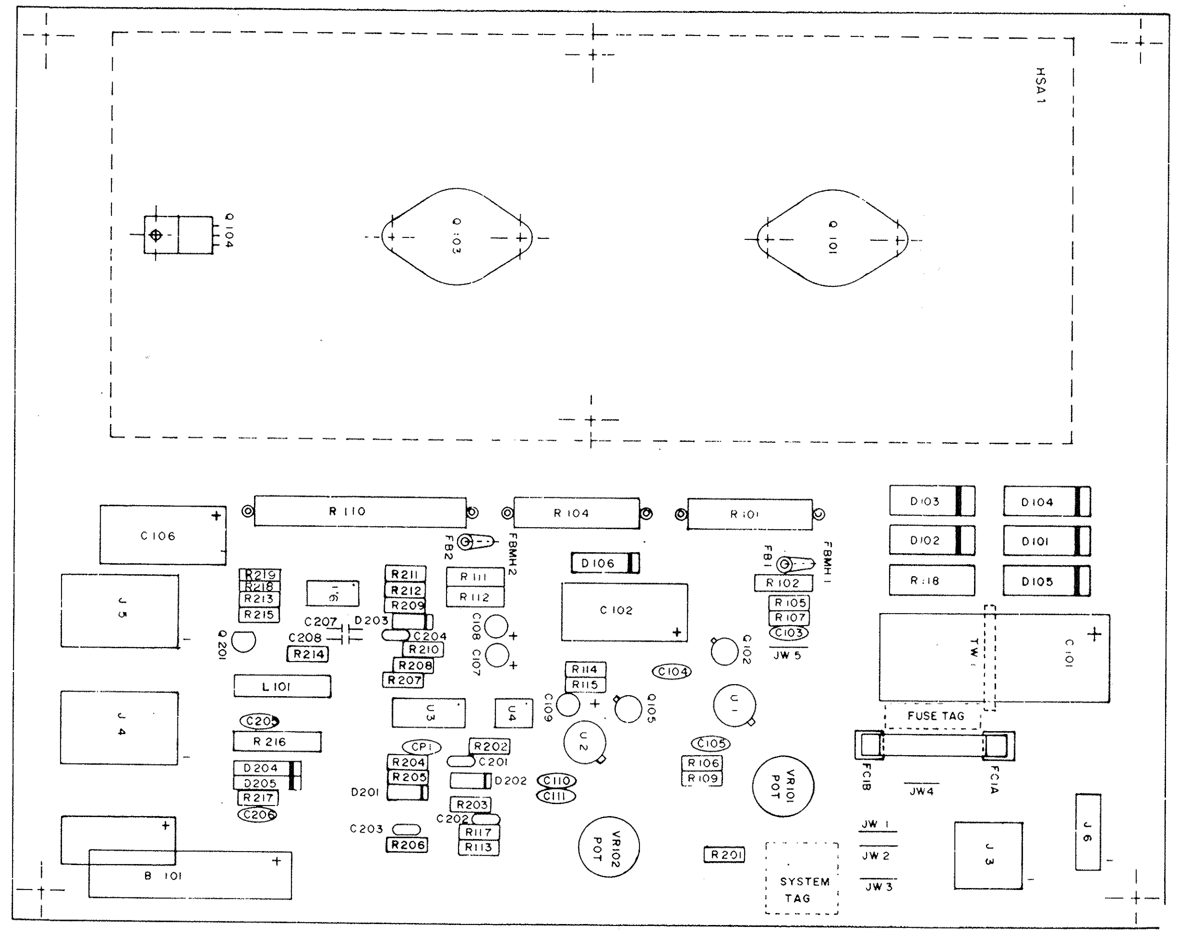
VIII. Schematics & Wiring Diagrams


VIDEO GENERATOR P.C.
A084-91391-A639
CPU P.C.
A084-90010-A639
POWER SUPPLY
A082-90412-B000
POWER CHASSIS
A945-00020-0000
SOUND I/O P.C.
A084-91483-A639
OPTICAL SENSOR P.C.
A084-91482-A000
SOLID STATE RELAY P.C.
A084-90509-C000
SENSOR P.C.
A084-91434-D639
ANALOG JOYSTICK P.C.
A084-91434-D639
DUAL POWER AMP P.C.
A084-90910-E000
MONITOR JACKS
VIDEO MONITOR
FLUORESCENT LIGHT
SAFETY SWITCH
POWER SWITCH
COIN DOOR LIGHTS
DISPLAY LIGHTS
AC MOTOR
COIN METER
LEFT SPEAKER
RIGHT SPEAKER
NEUTRAL
GND
HOT
3-1-83
M051-00639-A003
Kozmik Krooz'r
Bally-Midway
10601 W Belmont
Franklin Park, Il 60131
Notes
■ = 18 AWG WIRE
▲ = 18 AWG / 600 V WIRE

DESIGNATION LIST

DESIGNATION #	DESCRIPTION
C101	4700uf AX. ELECT.
C102	470uf AX. ELECT.
C103	.1uf AX. CER.
C104	.1uf AX. CER.
C105	47pf AX. CER.
C106	470uf AX. ELECT.
C107	100uf RD. TANT.
C108	1uf RD. TANT.
C109	4.7uf RD. TANT.
C110	.1uf AX. CER.
C111	.1uf AX. CER.
C201	.01uf MYLAR
C202	.033uf MYLAR
C203	.01uf MYLAR
C204	.047uf MYLAR
C205	820pf AX. CER.
C206 C208	.01uf AX. CER.
C207	0.082uf MYLAR
CP1	.1uf AX. CER.
R101	.18ohm 5W W/RES. SPACER
R102	68ohm 1/2W 5%
R104	10ohm 5W W/RES. SPACER
R105	27ohm 1/4W 5%
R106	270ohm 1/4W 5%
R107	6.2K 1/4W 5%
R109	1K 1/4W 5%
R110	.16ohm 15W W/RES. SPACER
R111	6.8ohm 1/2W5%
R112	68ohm 1/2W 5%
R113	1 2K 1/4W 5%
R114	47ohm 1/4W 5%
R115	160ohm 1/4W 5%

DESIGNATION #	DESCRIPTION
R117	560ohm 1/4W 5%
R118	150ohm 2W
R201	270ohm 1/4W 5%
R202	1.2K 1/4W 5%
R203	1.1M 1/4W 5%
R204	3.3M 1/4W 5%
R205	10M 1/4W 5%
R206	100K 1/4W 5%
R207	33K 1/4W 5%
R208	2M 1/4W 5%
R209	1M 1/4W 5%
R210	1.2M 1/4W 5%
R211	75K 1/4W 5%
R212	75K 1/4W 5%
R213	220K 1/4W 5%
R214	3.9K 1/4W 5%
R215	1.2K 1/4W 5%
R216	82ohm 1W 10%
R217	270ohm 1/4W 5%
R218	110K 1/4W 5%
R219	68ohm 1/2W5%
VR101,102	100ohm POT
D101	A15F
D102	A15F
D103	A15F
D104	A15F
D105	A15F
D106	1N4001
D201	1N4148
D202	1N4148
D203	1N4148
D204	1N4001
D205	1N4001
Q102	2N2905
Q105	2N2905
Q201	2N4401
U1	LM305 REG.
U2	LM305 REG.
U3	LM3900
U4	4N28
U6	555
L101	.22uH INDUCTOR
B101	BATTERY 3.6VDC 60DEG C
F1	3/8A S BLO FUSE
FC1A,1B	FUSE CLIP
FB1,2	FERRITE BEAD
TW1	TIE WRAP
J3	9PIN P.C. MOUNT CONN.(MALE)
J4	15PIN P.C. MOUNT CONN.(FEMALE)
J5	15PIN P.C. MOUNT CONN.(MALE)
J6	3PIN P.C. MOUNT CONN.(MALE)
LB1	FUSE TAG
LB2	SYSTEM TAG
HSA1	HEAT SINK ASS'Y 1
MHHSA1	MOUNTING HARD WARE(HEAT SINK) 2 SCREW 4 WASHER 2 HEXNUT
JW1 5	JUMPER WIRE
FBMH1,2	FERRITE BEAD MOUNTING HARDWARE

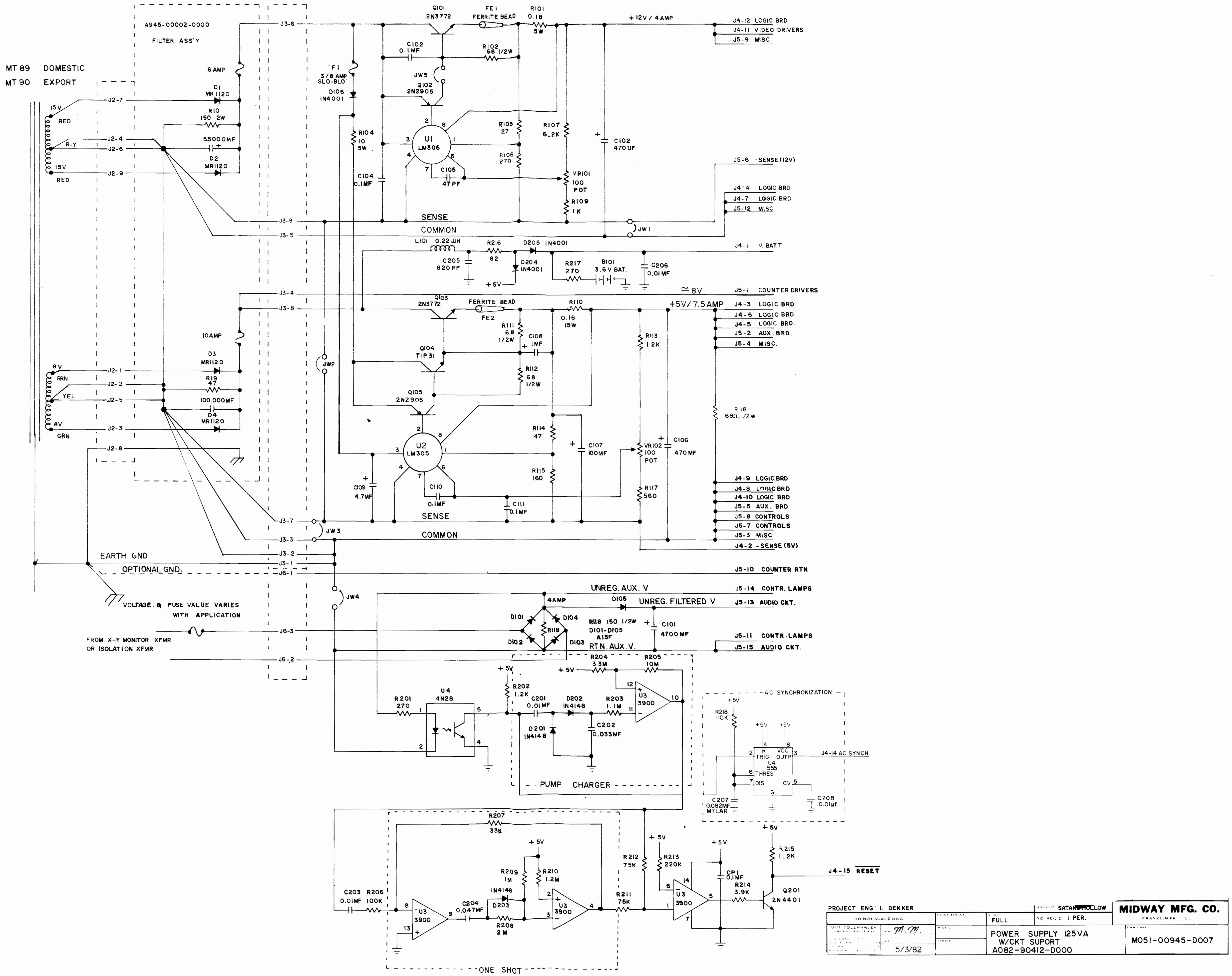


PROJ. ENG.: L. DEKKER

DO NOT SCALE DWG	SCALE FULL	NO REQ'D 1 PER.	MIDWAY MFG. CO. FRANKLIN PK. ILL.
DATE 5/14/82	ASSEMBLY DRAWING 125VA PWRSPY.	A082-90412-D000	PART NO. M051-00945-B006

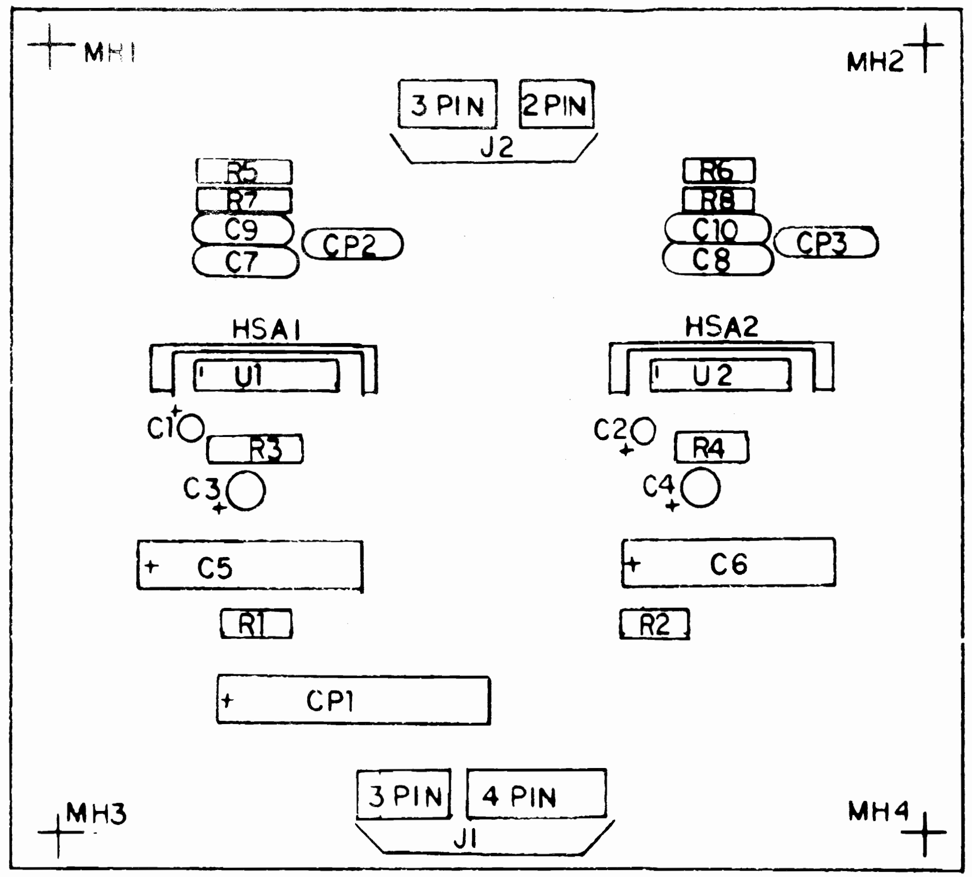
CROSS REFFERENCE LIST

DESCRIPTION	Q'ty	DESIGNATION #	PART #
47pf AX. CER.	1	C105	0945-00811-0100
820pf AX. CER.	1	C205	0945-00816-0400
.01uf AX. CER	2	C206,208	0945-00816-0100
.01uf MYLAR	2	C201,203	0945-00816-0200
.033uf MYLAR	1	C202	0945-00816-0500
.047uf MYLAR	1	C204	0945-00816-0300
0.082uf AX.CER	1	C207	0945-00816-1900
.1uf AX. CER.	5	C103,104,110,111, CP1	0945-00811-0200
1uf RAD. TANT	1	C108	0945-00811-0300
4.7uf RAD. TANT	1	C109	0945-00811-0400
100uf RAD. TANT	1	C107	0945-00811-0500
470uf AX. ELECT.	2	C102,106	0945-00816-0600
4700uf AX. ELECT.	1	C101	0945-00811-0700
.16ohm 15W 5%	1	R110	0945-00815-0100
.18ohm 5W 5%	1	R101	0945-00815-0200
6.8ohm 1/2W 5%	1	R111	0062-047D3-1XXX
10ohm 5W 5%	1	R104	0945-00812-0100
27ohm 1/4W 5%	1	R105	0062-068B3-1XXX
47ohm 1/4W 5%	1	R114	0062-086B3-1XXX
68ohm 1/2W 5%	3	R102,112,219	0062-098D3-1XXX
82ohm 1W 10%	1	R216	0062-104F5 1XXX
150ohm 2W 5%	1	R118	0945-00812-0200
160ohm 1/4W 5%	1	R115	0062-124B3-1XXX
270ohm 1/4W 5%	3	R106,201,217.	0062-138B3-1XXX
560ohm 1/4W 5%	1	R117	0062-162B3-1XXX
1K 1/4W 5%	1	R109	0062-179B3-1XXX
1.2K 1/4W 5%	3	R113,202,215	0062-183B3-1XXX
3.9K 1/4W 5%	1	R214	0062-207B3-1XXX
6.2K 1/4W 5%	1	R107	0062-217B3-1XXX
33K 1/4W 5%	1	R207	0062-251B3-1XXX
75K 1/4W 5%	2	R211,212	0062 269B3 1XXX
100K 1/4W 5%	1	R206	0062-275B3 1XXX
110K 1/4W 5%	1	R218	0062-277B3-1XXX
220K 1/4W 5%	1	R213	0062-291B3 1XXX
1M 1/4W 5%	1	R209	0062-323B3-1XXX
1.1M 1/4W 5%	1	R203	0062 325B3 1XXX
1.2M 1/4W 5%	1	R210	0062-327B3-1XXX
2M 1/4W 5%	1	R208	0062-337B3-1XXX
3.3M 1/4W 5%	1	R204	0062-347B3-1XXX
10M 1/4W 5%	1	R205	0062-371B3-1XXX
100ohm POT	2	VR101,102	0945-00814-0000
LM305 REG.	2	U1,2	0945-00813-0100
555	1	U6	0929-00810-4500
LM3900	1	U3	0945-00813-0200
4N28	1	U4	0945-00813-0300
A15F RECTIFIER	5	D101-105	0945-00804-0200
1N4001	3	D106,204,205	0945-00804-0300
1N4148	3	D201-203	0945-00804-0500
2N2905	2	Q102,105	0945-00808-0300
2N4401	1	Q201	0945-00804-0400
BATTERY 3.6VDC 60DEG-C	1	B101	0017-00003-0377
FUSE 3/8A S-BLO	1	F1	0945-00808-0400
FUSE CLIP	2	FC1A,1B	0017-00003-0214
TIE WRAP	1	TW1	0945-00814-0300
FERRITE BEAD	2	FB1,2	0017-00009-0225
FERRITE MOUNTING HDW.	2	FBMH1,2	0017-00033-0139
.22uH INDUCTOR	1	L101	0945-00814-0200
FUSE TAG	1		M051-00945-A004
SYSTEM TAG	1		M051-00945-A009
P.C.B.	1		A080-90412-D000
HEAT SINK ASS'Y (SEE HS ASS'Y DRAWING "** NOTE")	1	HSA1	A945-00008-0000
** 4-40X10 SLT RND	2	MH HSA 1A, 2A.	0017-00101-00727
** 4-40 HEX NUT	2	MH HSA 1E, 2E.	0017-00103-0002
** WSH 4-120-.250-018	4	MH HSA 1B,1D MH HSA 2B,2D	0017-00104-0071
3PIN P.C. MOUNT CONN. (MALE)	1	J6	0017-00021-0443
9PIN P.C. MOUNT CONN.(MALE)	1	J3	0017-00021-0425
15PIN P.C. MOUNT CONN.(FEMALE)	1	J4	0017-00021-0441
15PIN P.C. MOUNT CONN.(MALE)	1	J5	0017-00021-0440
22AWG T&R BARE 2.5"	5	JW1-5	0151-00087-0000


MT 89 DOMESTIC
MT 90 EXPORT
A945-00002-0000
FILTER ASS'Y
6 AMP
10AMP
Q101 2N3772
FE1 FERRITE BEAD
R101 0.18 5W
+12V / 4AMP
J4-12 LOGIC BRD
J4-11 VIDEO DRIVERS
J5-9 MISC
F1 3/8 AMP SLO-BLO
D106 1N4001
U1 LM305
U2 LM305
SENSE
COMMON
J5-6 -SENSE (12V)
J4-4 LOGIC BRD
J4-7 LOGIC BRD
J5-12 MISC
J4-1 V. BATT
B101 3.6 V BAT.
≃ 8V
J5-1 COUNTER DRIVERS
Q103 2N3772
+5V/7.5AMP
J4-3 LOGIC BRD
J4-6 LOGIC BRD
J4-5 LOGIC BRD
J5-2 AUX. BRD
J5-4 MISC.
J4-9 LOGIC BRD
J4-8 LOGIC BRD
J4-10 LOGIC BRD
J5-5 AUX. BRD
J5-8 CONTROLS
J5-7 CONTROLS
J5-3 MISC
J4-2 -SENSE (5V)
EARTH GND
OPTIONAL GND.
J5-10 COUNTER RTN
VOLTAGE & FUSE VALUE VARIES WITH APPLICATION
FROM X-Y MONITOR XFMR OR ISOLATION XFMR
UNREG. AUX. V
J5-14 CONTR. LAMPS
UNREG. FILTERED V
J5-13 AUDIO CKT.
R118 150 1/2W
D101-D105 A15F
RTN. AUX. V.
J5-11 CONTR. LAMPS
J5-15 AUDIO CKT.
U4 4N28
PUMP CHARGER
AC SYNCHRONIZATION
U4 555
J4-14 AC SYNCH
ONE SHOT
J4-15 RESET
Q201 2N4401
PROJECT ENG: L. DEKKER
DO NOT SCALE DWG
FULL
5/3/82
USED ON SATAN'S HOLLOW
NO. REQ'D 1 PER.
MIDWAY MFG. CO.
FRANKLIN PK. ILL
POWER SUPPLY 125VA W/CKT SUPORT
A082-90412-D000
M051-00945-D007

DESIGNATION LIST

DESIGNATION	DESCRIPTION
C1,C2	4.7 mf 25v rd. tant.
C3,C4	22 mf 6v " "
C5,C6	470mf 6v ax. elect.
C7-C10	.1 mf 50v ax. cr.
CP1	220mf 25v ax. elect.
CP2,CP3	.1 mf 50v ax. cr.
R1,R2	2.7KΩ 1/4w 5% CRBN.
R3,R4	27Ω " " "
R5-R8	1Ω 1/2w " "
U1,U2	MB3730
J1	3 PIN STRT. KK156 4 " " "
J2	3 " " " 2 " " "
HSA1,2	HEATSINK ASSY.
MH1-MH4	HEYCO BUSHING



CROSS REFERENCE LIST

DESCRIPTION	QTY	DESIGNATION	PART NO
.1mf 50v ax.cr.	6	C7-C10, CP2,CP3	0986-00800-1100
4.7 mf 25v rd. tant.	2	C1,C2	0986-00800-3100
22 mf 6v " "	2	C3,C4	0986-00800-1600
220mf 25v ax. elec.	1	CP1	0986-00800-3200
470mf 6v " "	2	C5,C6	0986-00800-1700
1Ω 1/2w 5%	4	R5-R8	0062-026D3-1XXX
27Ω 1/4w "	2	R3,R4	0062-068B3-1XXX
2.7K " "	2	R1,R2	0062-199B3-1XXX
MB3730	2	U1,U2	0066-188XX-XX4X
2 PIN STRT. KK156	1	J2	3000-16367-0200
3 " " "	2	J1,J2	3000-16367-0300
4 " " "	1	J1	3000-16367-0400
HEATSINK ASSY.	2	HSA1, HSA2	A986-00010-E000
HEYCO BUSHING	4	MH1-MH4	0017-00042-0014
PC BOARD	1		A080-90910-E000

PROJECT ENG. C. MEDNICK

DIM. TOLERANCES
UNLESS OTHERWISE SPEC.
CONCENTRICITY T.I.R. .002
FRACTIONAL ± 1/64
DECIMAL ± .005
HOLE DIA. + .002 — .000
ANGLE ± 1/2°
DO NOT SCALE DWG

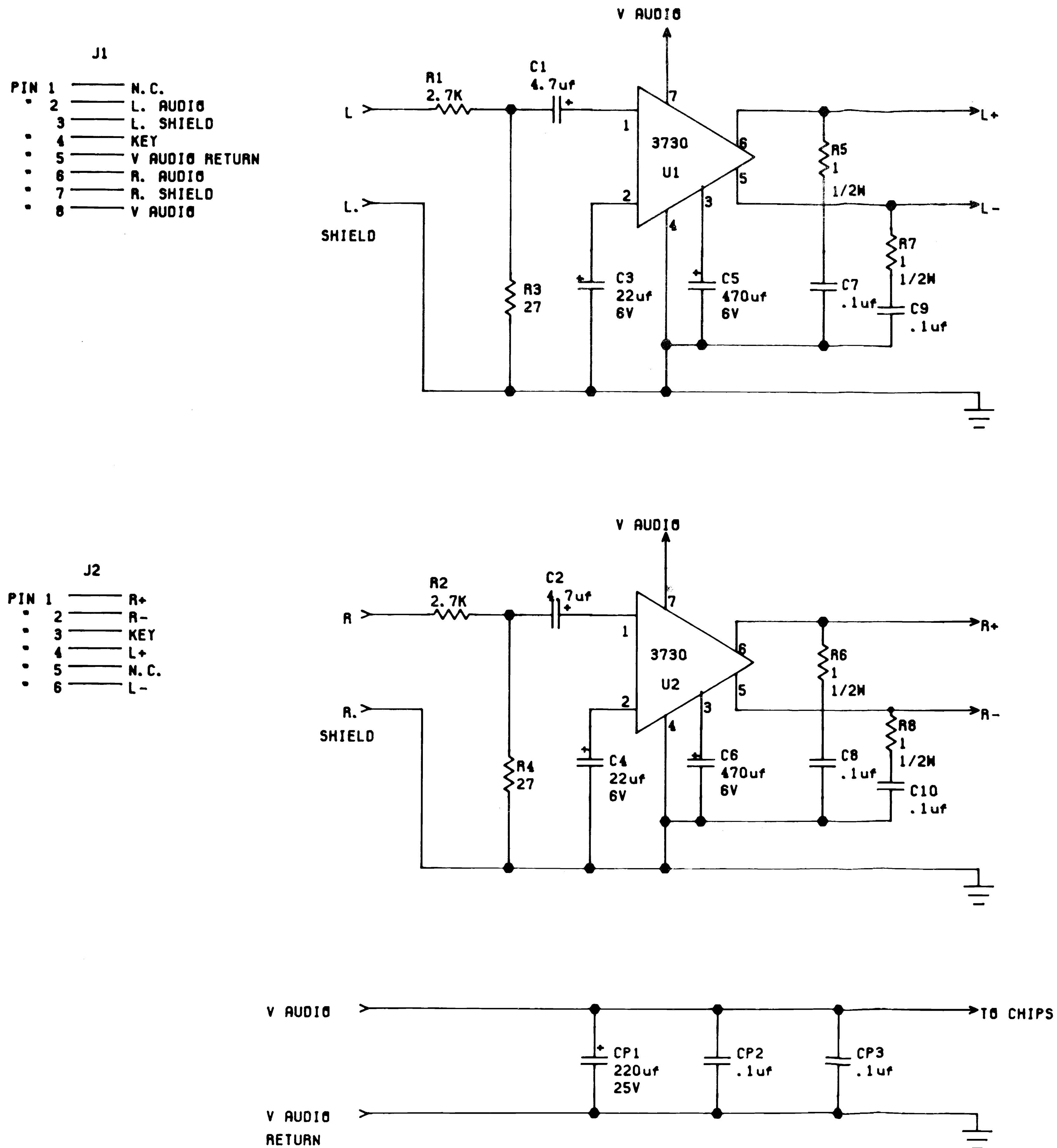
FIRST USED ON: TRON
DRN: TJK | DATE: 9-1-82 | SCALE: FULL
MECH CHK | MAT'L
ELEC CHK: C. M. M. | FINISH

MIDWAY MFG. CO.
FRANKLIN PK., IL. 60131 — A BALLY CO.

DUAL PWR. AMP. ASSY
A080-90910-E000

REVISIONS

PART NO: M051-00986-E010



REVISIONS

MIDWAY MFG. CO.
FRANKLIN PK. ILL.

PART NO. M051-00986-E011

USED ON TRON

NO REQ'D 1 PER.

SCALE NONE

SCHEMATIC, DUAL POWER AMP.

A082-90910-E000

HEAT TREAT

MAT'L

FINISH

DO NOT SCALE DWG.

DRN.

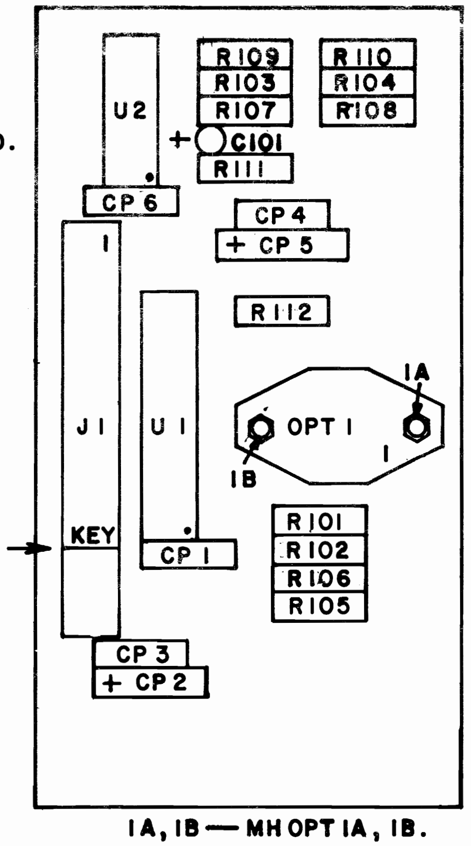
CKD.

DATE 9/1/82

DIM TOLERANCES UNLESS SPECIFIED
CONCENTRICITY T.I.R. .003
FRACTIONAL ±1/64
DECIMAL ±.005
HOLE DIA +.002 -.000

DESIGNATION LIST

DESGN. NO.	DESCRIPTION
C101	4.7 µf TANT 16V RAD.
CP 1	.01 µf 50V AX. CER.
CP 2	10 µf 16V AX. ELECT.
CP 3	.01 µf 50V AX. CER.
CP 4	.01 µf 50V AX. CER.
CP 5	10 µf 16V AX. ELECT.
CP 6	.01 µf 50V AX. CER.
R101	4.7K 1/4W 5%
R102	4.7K 1/4W 5%
R103	200K 1/4W 5%
R104	200K 1/4W 5%
R105	6.2K 1/4W 5%
R106	120 ohm 1/4W 5%
R107	30 K 1/4W 5%
R108	91 K 1/4W 5%
R109	200K 1/4W 5%
R110	200K 1/4W 5%
R111	4.7 K 1/4W 5%
R112	6.2 K 1/4W 5%
OPT 1	OPTICAL SENSOR
U 1	74LS491
U 2	LM 339
J 1	13 PIN KK-156 RT. ANGLE (PIN 11 OMITTED)
MH OPT 1A, 1B	PLASTIC RIVET RND. HD.
A082-91482-A000	P.C.B.



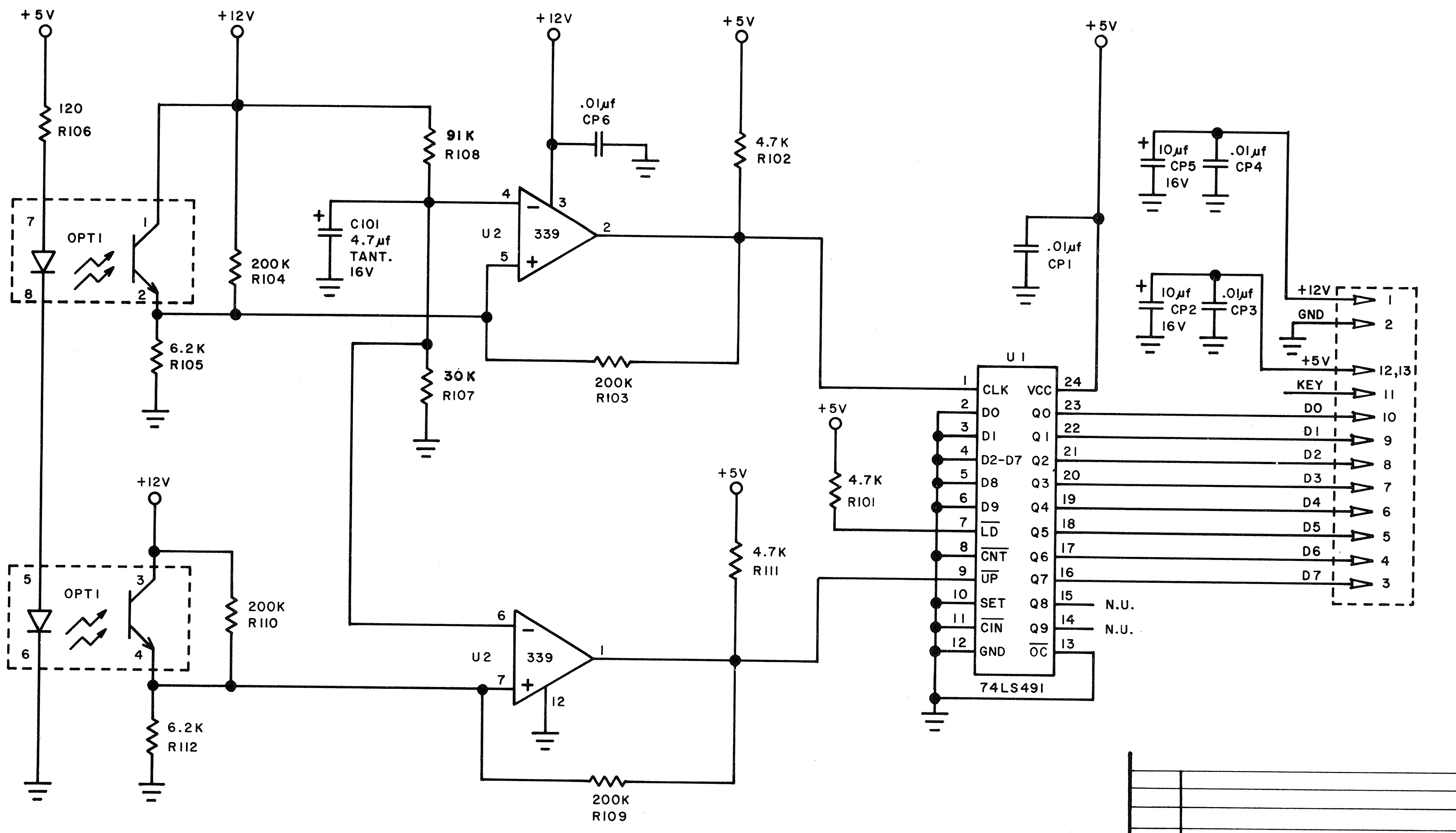
1A, 1B — MH OPT 1A, 1B.

CROSS REFERENCE LIST

DESCRIPTION	QTY	DESGN. NO.	PART NO.
.01 µf 50V AX. CER.	4	CP1,3,4,6.	0628-00800-0100
4.7 µf 16V RAD. TANT.	1	C101	0628-00800-0200
10 µf 16V AX. ELECT.	2	CP2,5	0628-00800-0300
120 ohm 1/4W 5%	1	R106	0062-116B3-1XXX
4.7K 1/4W 5%	3	R101,102,111.	0062-211B3-1XXX
6.2K 1/4W 5%	2	R105, 112	0062-217B3-1XXX
30 K 1/4W 5%	1	R107	0062-249B3-1XXX
91 K 1/4W 5%	1	R108	0062-273B3-1XXX
200K 1/4W 5%	4	R103,104,109,110.	0062-289B3-1XXX
74LS491	1	U1	0628-00803-2700
LM 339	1	U2	0628-00803-2900
OPTICAL SENSOR	1	OPT1	0628-00804-0100
13 PIN KK-156 (RT. ANGLE PIN 11 OMITTED)	1	J 1	3000-16387-1311
PLASTIC RIVET RND. HD.	2	MH OPT 1A, 1B.	0017-00072-0091
P.C.B.	1		A082-91482-A000

REVISIONS

PROJECT ENG: JOHN BOYDSTON	USED ON KOZMIK KROOZ'R	Bally / MIDWAY MFG. CO. FRANKLIN PK. ILL.
DO NOT SCALE DWG. / HEAT TREAT / SCALE	NO. REQ'D 1 PER	
DIM. TOLERANCES UNLESS SPECIFIED: CONCENTRICITY T.I.R. .003; FRACTIONAL ± 1/64; DECIMAL ± .005; HOLE DIA. +.002 -.000	DRN. C.L. / CKD. JBB / DATE 2/17/83	MAT'L. / FINISH
ASSY DRAWING OPTICAL SENSOR A082-91482-A000 A084-91482-A000	PART NO. M051-00114-A022	



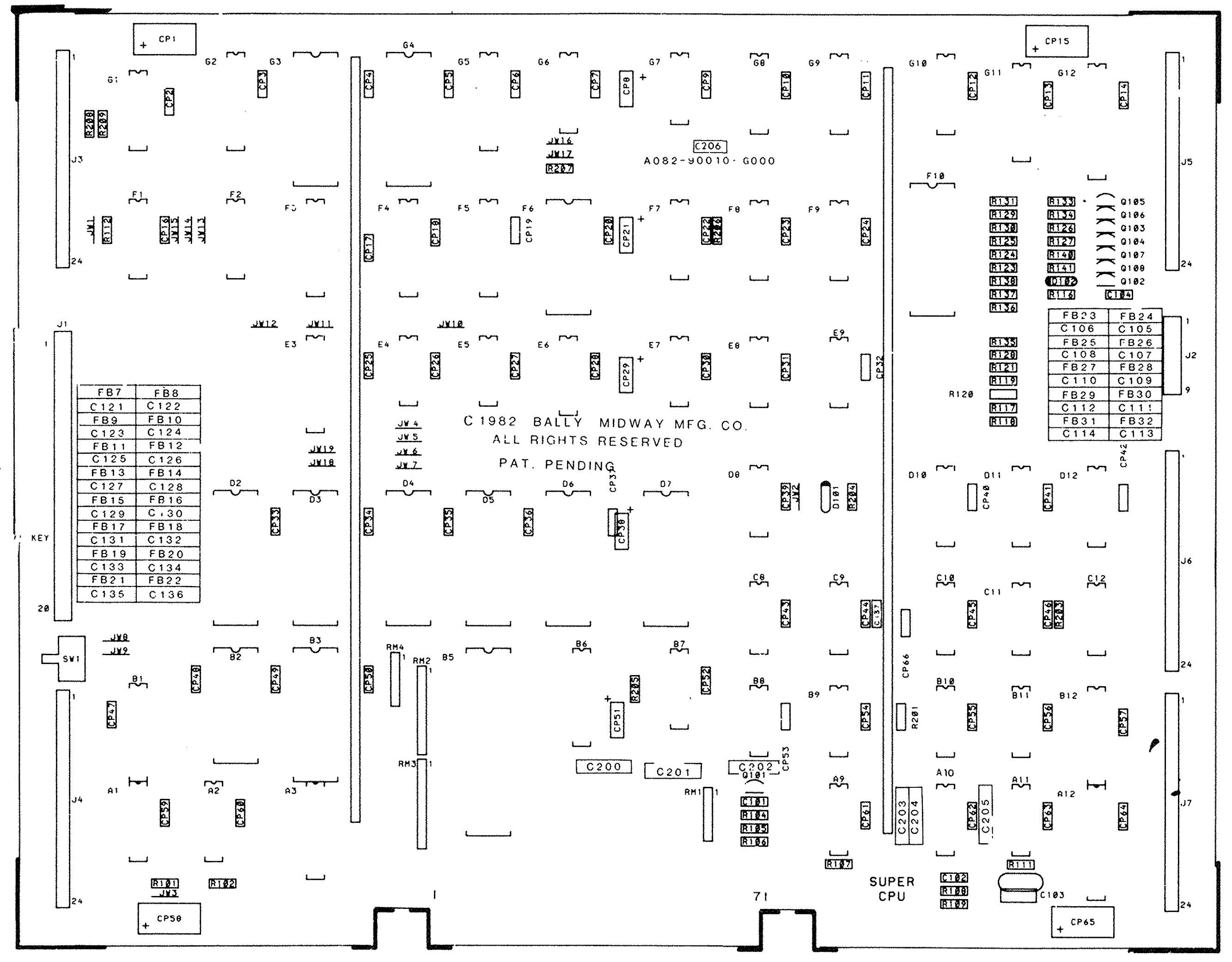
REVISIONS			
PROJECT ENG: JOHN BOYDSTON		USED O KOZMIK KROOZ'R	Bally / MIDWAY MFG. CO. FRANKLIN PK. ILL.
DO NOT SCALE DWG	HEAT TREAT	SCALE	NO. REQ'D 1 PER
DIM. TOLERANCES UNLESS SPECIFIED	DRN. C.L.	MAT'L.	SCHEMATIC DRAWING OPTICAL SENSOR A082-91482-A000 A084-91482-A000
CONCENTRICITY T.I.R. .003 FRACTIONAL 1/64 DECIMAL .005 HOLE DIA +.002 .000	CKD. JBB	FINISH	PART NO. M051-00114-A023
	DATE 2/17/83		

DESIGNATION LIST

DESIGNATION	DESCRIPTION
C101	33PF AX. CER.
C102	0.1UF AX. CER.
C103	0.1UF MYLAR
C104	390PF AX.CER.
C105 - C110	47 PF AX.CER.
C111 - C114	820 PF AX.CER.
C121 - C137	390 PF. AX.CER.
C 200	820 PF. AX.CER.
C 201, C 202	390 PF. AX.CER.
C 203	100 PF AX.CER.
C 204	470 PF. AX.CER.
C 206	100 PF. AX. CER.
CP1	470UF 16V ELECT. AX.
CP2-CP7	0.01UF 50V AX.CER.
CP8	10UF 25V AX. TANT.
CP9 - CP14	0.01UF 50V AX. CER.
CP15	470UF 16V ELECT. AX.
CP16 - CP20	0.01UF 50V AX. CER.
CP21	10UF
CP22 - CP28	0.01UF
CP29	10UF
CP30 - CP37	0.01UF
CP38	10UF
CP39 - CP50	0.01UF
CP51	10UF
CP52 - CP57	0.01UF
CP58	470UF 16V ELECT.AX.
CP59 - CP64	0.01UF
CP65	470UF
CP66	0.1UF 50V AX. CER.
R101	4.7K OHM 1/4W CRBN.
R102	1K OHM " "
R104	1.2K OHM " "
R105	220 OHM " "
R106	22 OHM " "
R107	1K OHM " "
R108	330 OHM " "
R109	1K OHM " "
R111	330 OHM " "
R112	4.7K OHM " "
R116	1K OHM " "
R117, R118	560 OHM " "
R119	100 OHM " "
R120	820 OHM " "
R121	470 OHM " "
R123	510 OHM " "
R124	1K OHM " "
R125	2K OHM " "
R126, R127	10 OHM " "
R128	470 OHM " "
R129	1K OHM " "
R130	510 OHM " "
R131	2K OHM " "
R133, R134	10 OHM " "
R135	470 OHM " "
R136	510 OHM " "
R137	1K OHM " "
R138	2K OHM " "
R140, R141	10 OHM " "

DESIGNATION	DESCRIPTION
R201	1K OHM " "
R203-R207	1K OHM " "
R208, R209	4.7K OHM " "
RM1	4.7K 6 PIN S.I.P.
RM2, RM3	4.7K 10 PIN S.I.P.
RM4	4.7K 6 PIN S.I.P.
D101	1N5817
D102	4148
Q101	2N4403
Q102	2N4123
Q103-Q108	MPSA70
A1	74LS161
A2	74LS367
A3	74LS245
A9	7474
A10	74S74
A11	74S04
A12	H-T
B1	74LS244
B2	CMOS RAM
B3	MK3882
B5	MK3880
B6	74LS244
B7	74LS133
B8	74LS32
B9	74S04
B10	74LS74
B11	74LS32
B12	V & H-T
C8	74LS08
C9	74LS74
C10	74S04
C11, C12	74LS20
D2	EPROM
D3	EPROM
D4	EPROM
D5	EPROM
D6	EPROM
D7	EPROM
D8	74LS04
D10-D12	74LS157
E3	NVR CONTROLLER
E4, E5	74LS32
E6	74LS138
E7	74LS86
E8	74LS27
E9	74LS04

DESIGNATION	DESCRIPTION
F1	4053
F2	4017
F3	74LS245
F4, F5	74LS273
F6	6116
F7	74LS174
F8, F9	74LS157
F10	93419
G1	74LS153
G2	74LS273
G3	EPROM
G4	EPROM
G5	74LS273
G6	74LS153
G7	74LS86
G8	74LS174
G9, G10	74LS157
G11	CUSTOM IC
G12	V-T GEN.
FB7 - FB32	FERRITE BEAD
ICSA12	8PIN IC SOCKET
ICSA12A	16PIN" "
ICSB2	24PIN" "
ICSB3	28PIN" "
ICSB5	40PIN" "
ICSB12	20PIN" "
ICSD2, D3, D4, D5, D6, D7	28PIN" "
ICSE3	20 PIN" "
ICSF6	24PIN" "
ICSF10	28PIN" "
	28PIN" "
ICSG11	20PIN" "
ICSG12	8PIN " "
ICSG12A	16PIN " "
J1A	KK156 RT. ANGLE 5PIN
J1	KK156 " " 14 PIN
J2A	KK100 RT. ANGLE 2 PIN
J2	KK100 " " 6 PIN
J3, J4, J5, J6, J7	KK100 " " 24PIN
JW1 - JW19	ZERO OHM RESISTORS
SW1	SWITCH P.C. MOUNTING
XTAL	19,968 MHZ CRYSTAL
BB1, BB2	BUS BAR
J3, J4, J5, J6, J7	FLEX-PAC JUMPER
A080-90010-F000	SUPER CPU BOARD

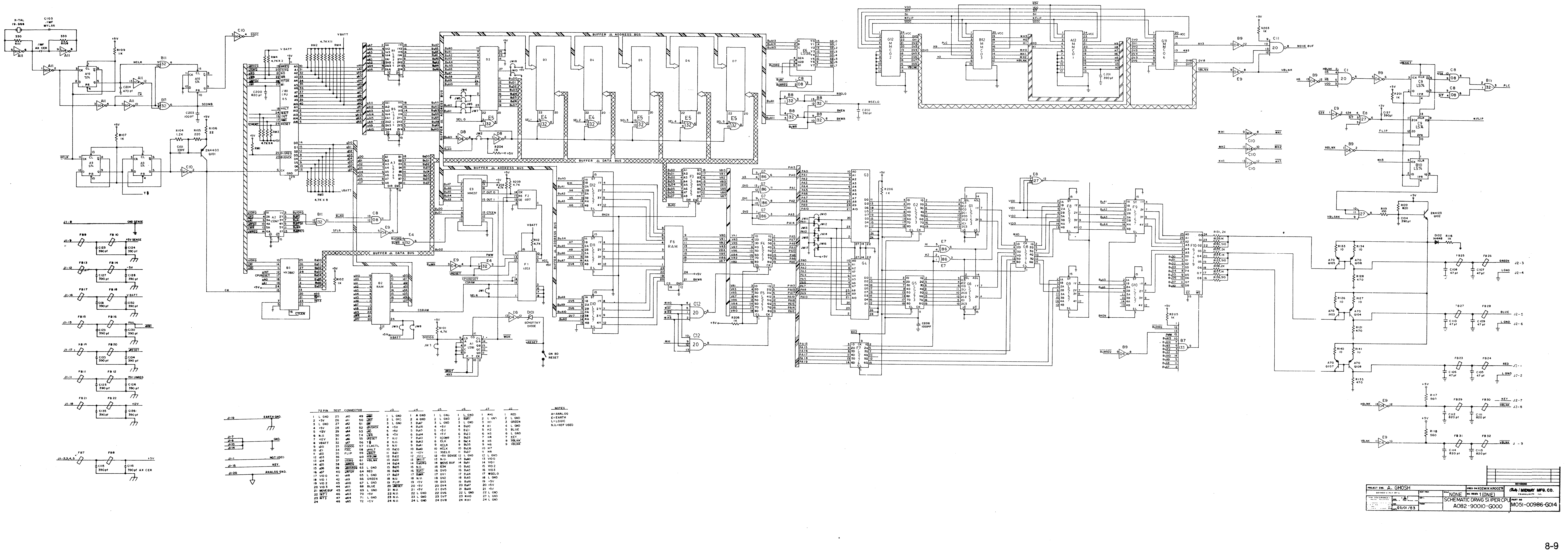


CROSS REFERENCE LIST

DESCRIPTION	QTY.	DESIGNATION	PART NOS.
33 PF AX.CER.	1	C101	0986-00800-0300
47 PF AX CER	6	C105 - C110	0986-00800-2800
100 PF AX CER.	2	C203, C206	0986-00800-1000
390 PF AX CER	20	C104, C121-C137, C201, C202	0986-00800-3000
470 PF AX.CER.	1	C 204	0986-00800-3502
820 PF AX.CER.	5	C111-C114, C200	0986-00800-3501
0.01UF 50V AX.CER.	56	CP2-CP7, CP9-CP14, CP16-CP20, CP22-CP28, CP30-CP37, CP39-CP50, CP52-CP57, CP59-CP64	0986-00800-2200
0.1MF 100V MYLAR	1	C103	0986-00800-0100
0.1MF 50V AX. CER.	2	C102, CP66	0986-00800-0200
10MF 25V AX. TANT	5	CP8, CP21, CP29, CP38, CP51	0986-00800-3400
470UF 16V AX. ELECT	4	CP1, CP15, CP58, CP65	0986-00800-3300
10 OHM 1/4W CRBN.	6	R126, R127, R133, R134, R140, R141	0062-051B3-1XXX
22 OHM " "	1	R106	0062-063B3-1XXX
100 OHM" "	1	R119	0062-110B3-1XXX
220 OHM" "	1	R105	0062-133B3-1XXX
330 OHM " "	2	R108, R111	0062-144B3-1XXX
470 OHM " "	3	R121, R128, R135	0062-156B3-1XXX
510 OHM " "	3	R123, R130, R136	0062-159B3-1XXX
560 OHM " "	2	R117, R118	0062-162B3-1XXX
820 OHM " "	1	R120	0062-174B3-1XXX
1K OHM " "	13	R102, R107, R109, R116, R124, R129, R137, R201, R203-R207	0062-179B3-1XXX
1.2K OHM" "	1	R104	0062-183B3-1XXX
2K OHM " "	3	R125, R131, R138	0062-193B3-1XXX
4.7K OHM" "	4	R101, R112, R208, R209	0062-211B3-1XXX
4.7K 6PIN S.I.P.	2	RM1, RM4	0986-00804-2400
4.7K 10PIN S.I.P	2	RM2, RM3	0986-00804-4600
1N5817	1	D101	0986-00801-0300
4148	1	D102	0986-00801-0100
2N4403	1	Q101	0986-00802-0200
2N4123	1	Q102	0986-00802-0100
MPSA70	6	Q103-Q108	0986-00802-0300
74S04	3	A11, B9, C10	0986-00803-0400
74LS04	2	D8, E9	0986-00803-1007
74LS08	1	C8	0986-00803-1006
74LS20	2	C11, C12	0986-00803-1004
74LS27	1	E8	0986-00803-9500
74LS32	4	B8, B11, E4, E5	0986-00803-0600
7474	1	A9	0986-00803-1009
74S74	1	A10	0986-00803-1500
74LS74	2	B10, C9	0986-00803-1005
74LS86	2	E7, G7	0986-00803-9900
74LS133	1	B7	0986-00803-1002
74LS138	1	E6	0986-00803-1900
74LS153	2	G1, G6	0986-00803-1000
74LS157	7	D10, D11, D12, F8, F9, G9, G10	0986-00803-9700

DESCRIPTION	QTY.	DESIGNATION	PART NOS.
74LS161	1	A1	0986-00803-1003
74LS174	2	F7, G8	0986-00803-9800
74LS244	2	B1, B6	0986-00803-0800
74LS245	2	A3, F3	0986-00803-0900
74LS273	4	F4, F5, G2, G5	0986-00803-1001
74LS367	1	A2	0986-00803-2200
MK3380	1	B5	0986-00803-7800
MK3382	1	B3	0986-00803-7700
4017	1	F2	0986-00803-8700
4053	1	F1	0986-00803-2000
CMOS RAM	1	B2	0986-00803-8100
6116	1	F6	0986-00803-1008
93419	1	F10	0986-00803-9600
H-T GEN.	1	A12	0986-00803-8900
V-T GEN.	1	G12	0986-00803-9000
V & H GEN.	1	B12	0986-00803-9100
MISC. CUSTOM	1	G11	0986-00803-9200
NVR CONTROLLER	1	E3	0986-00804-3200
EPROM	1	D2	ROM/EPROM OPTIONS KIT 0639-00803-0007
EPROM	1	D3	
EPROM	1	D4	
EPROM	1	D5	
EPROM	1	D6	
EPROM	1	D7	
EPROM	1	G3	
EPROM	1	G4	
8 PIN IC SOCKET	2	ICSA12, ICSG12	0986-00804-3600
16PIN " "	2	ICSA12A, ICSG12A	0986-00804-3700
20PIN " "	3	ICSB12, ICSE3, ICSG11	0986-00804-3800
24 PIN " "	2	ICSB2, ICSF6	0986-00804-3400
28 PIN " "	10	ICSB3, ICSD2, ICSD3, ICSD4, ICSD5, ICSD6, ICSD7, ICSF10, ICSG3, ICSG4,	0986-00804-3900
40PIN " "	1	ICSB5	0986-00804-3500
FERRITE BEADS	26	FB7 - FB32	0316-00804-0002
KK100 RT. ANGLE 2 PIN CONN.	1	J2A	0986-00804-4200
KK100 RT. ANGLE 6 PIN CONN.	1	J2	0986-00804-4300
KK156 RT. ANGLE 5PIN CONN.	1	J1A	0986-00804-4400
KK156 RT. ANGLE 14 PIN CONN	1	J1	0986-00804-4500
KK100 RT. ANGLE 24 PIN CONN.	5	J3, J4, J5, J6, J7	0986-00804-4700
ZERO OHM RESISTORS	19	JW1 - JW19	0986-00804-4000
SWITCH P.C. MOUNTING	1	SW1	0986-00804-3100
19,968 MHZ CRYSTAL	1	XTAL	0986-00804-4900
BUS BAR	2	BB1, BB2	0986-00804-4100
FLEX-PAC	5	J3, J4, J5, J6, J7	0986-00804-4800

PROJECT ENG A. GOSH		USED ON KOZMIK KROOZ'R	Bally / MIDWAY MFG. CO. FRANKLIN PK. ILL.
DRN. TF	HEAT TREAT	SCALE FULL	NO. REQ'D 1 PER
CKD.	MAT'L	SUPER CPU BOARD ASSY DWG. A082-90010-G000	PART NO M051 - 00639 - A036
DATE 02/18/83	FINISH		

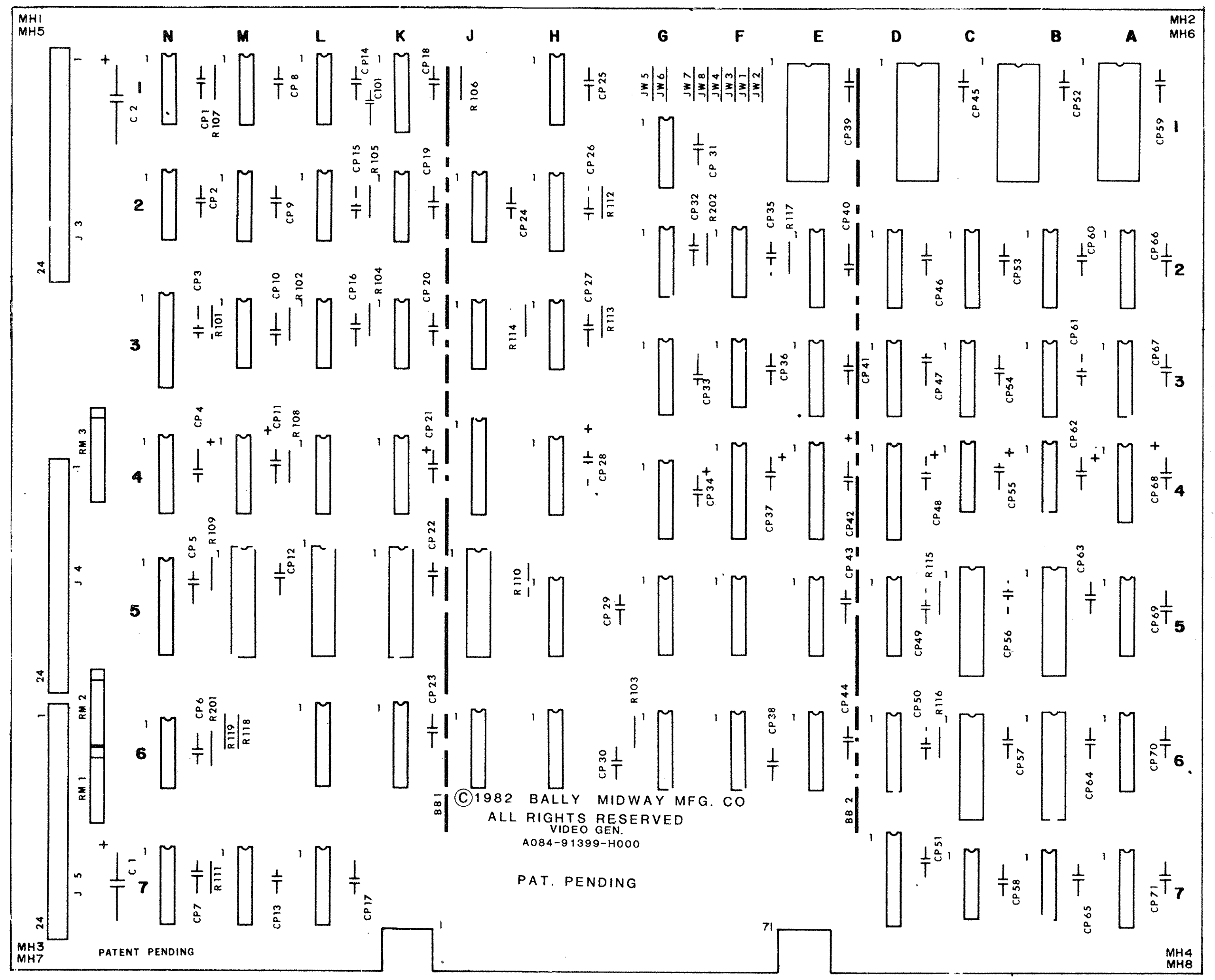

PROJECT ENG. A. GHOSH
USED ON KOZMIK KROOZ'R
SCALE NONE
NO. REQ'D 1 (ONE)
Bally / MIDWAY MFG. CO.
FRANKLIN PK. ILL
SCHEMATIC DRWG SUPER CPU
A082-90010-G000
PART NO M051-00986-G014
DATE 03/01/83
REVISIONS

DESIGNATION LIST

DESIGNATION	DESCRIPTION
C1, 2	100 µf AX. ELECT
C101	100 pf AX. CER.
CP1-3, 5-10 CP12-20, 22-27, CP29-33, 35, 36, CP38-41, 43-47, CP49-54, 56-61, CP63-67, 69-71.	.01 µf AX. CER.
CP4, 11, 21, 28, 34, CP37, 42, 48, 55, CP62, 68.	10 µf 25V AX. TANT.
R101-119, 201, 202.	1 K 1/4W 5%
RM1, 2	8PIN 1 K SIP
RM 3	10PIN 1 K SIP
IC A 1	EPROM
IC A 2	74 LS157
IC A 3	74 LS157
IC A 4	74 LS157
IC A 5	74 LS157
IC A 6	74 LS157
IC A 7	74 LS157
IC B 1	EPROM
IC B 2	74 LS194
IC B 3	74 LS194
IC B 4	74 LS32
IC B 5	422
IC B 6	422
IC B 7	74LS32
IC C 1	EPROM
IC C 2	74 LS194
IC C 3	74 LS194
IC C 4	74 LS32
IC C 5	422
IC C 6	422
IC C 7	74 LS32

DESIGNATION	DESCRIPTION
IC D 1	EPROM
IC D 2	74 LS194
IC D 3	74 LS194
IC D 4	74 LS273
IC D 5	74 LS157
IC D 6	74 LS157
IC D 7	74 LS273
IC E 2	74 LS194
IC E 3	74 LS194
IC E 4	74 LS374
IC E 5	74 LS157
IC E 6	74 LS157
IC F 2	7400
IC F 3	74 S04
IC F 4	74 LS374
IC F 5	74 LS157
IC F 6	74 LS157
IC G 1	74 LS86
IC G 2	74 LS20
IC G 3	74 LS283
IC G 4	74 LS283
IC G 5	74 LS283
IC G 6	74 LS157
IC H 1	74 LS86
IC H 2	74174
IC H 3	74 S74
IC H 4	74175
IC H 5	74174
IC H 6	74 LS157
IC J 2	7430
IC J 3	7430
IC J 4	74 LS273
IC J 5	422
IC J 6	74 LS157
IC K 1	74161
IC K 2	7430
IC K 3	7474
IC K 4	74161
IC K 5	422
IC K 6	2114-2

DESIGNATION	DESCRIPTION
IC L 1	74 LS20
IC L 2	7408
IC L 3	7474
IC L 4	74 LS283
IC L 5	422
IC L 6	2114-2
IC L 7	74 LS157
IC M 1	7430
IC M 2	7432
IC M 3	74 S74
IC M 4	74161
IC M 5	422
IC M 7	74 LS157
IC N 1	7430
IC N 2	7427
IC N 3	74 LS273
IC N 4	74 LS283
IC N 5	74 LS245
IC N 6	7404
IC N 7	74 LS157
ICS A1, B1, C1, D1.	28PIN IC SOCKET
ICS B5,6, C5,6, J5, K5, L5, M5.	22PIN IC SOCKET
ICS K6, L6.	18PIN IC SOCKET
J3,4,5	24 PIN RIGHT ANGLE CONN.
JW1-JW8	JUMPER WIRE
BB1, 2	BUSS BAR
PCMH1-4	PC BD SPACER
PCMH5-8	PC MTG SCREW
A080-91399-H000	VID. GEN. PC

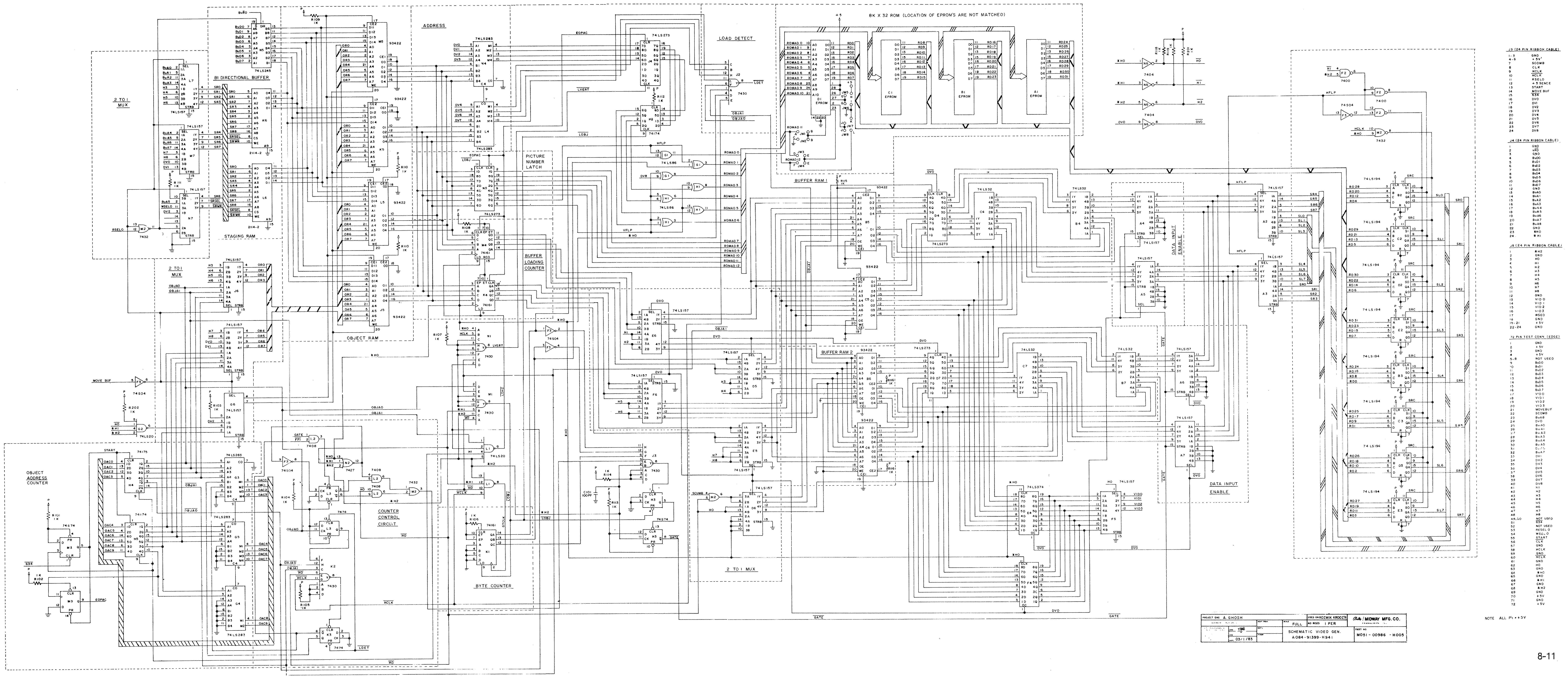


CROSS REFERENCE LIST

DESCRIPTION	Q'TY	DESIGNATION	PART NO.
100 Pf 50 V AX. CER.	1	C101	0986-00800-1000
.01 µf 50V AX. CER.	60	CP1-3, CP5-10, CP12-20, CP22-27, CP29-33, CP35, 36, CP38-41, CP43-47, CP49-54, CP56-61, CP63-67, CP69-71.	0986-00800-2500
10 µf 25 V AX. TANT.	11	CP4, 11, 21, 28, 34, 37, CP42, 48, 55, 62, 68.	0986-00800-2400
100 µf 25 V AX. ELECT.	2	C1, 2.	0986-00800-1800
1 K 1/4 W CRBN. FLM.	21	R101-119, 201, 202.	0062-17983-1XXX
1 K 8 PIN SIP	2	RM1, 2.	0986-00804-1100
1 K 10 PIN SIP	1	RM 3	0986-00804-1000
2114-2	2	K6, L6.	0986-00803-2300
7400	1	F 2	0986-00803-2800
7404	1	N 6	0986-00803-8300
74S04	1	F 3	0986-00803-3100
7408	1	L 2	0986-00803-3200
74LS20	2	G2, L1	0986-00803-3400
7427	1	N 2	0986-00803-3500
7430	5	J2, J3, K2, M1, N1	0986-00803-3600
7432	1	M 2	0986-00803-4400
74LS32	4	B4,7, C4,7,	0986-00803-3700
7474	2	K3, L3	0986-00803-4500
74S74	2	H3, M3	0986-00803-4100
74LS86	2	G1, H1	0986-00803-4200
74LS157	18	A2,3,4,5,6,7, D5,6, E5,6, F5,6, G6, H6, J6, L7, M7, N7.	0986-00803-2400
74161	3	K1, K4, M4.	0986-00803-2500
74174	2	H2, 5	0986-00803-2600
74175	1	H4	0986-00803-2700
74LS194	8	B2,3, C2,3, D2,3, E2,3.	0986-00803-2900
74LS245	1	N5	0986-00803-3000
74LS273	4	D4,7, J4, N3	0986-00803-3800
74LS283	5	G3,4,5 L4, N4,	0986-00803-3900
74LS374	2	E4, F4	0986-00803-4000
93422	4	J5, K5, L5, M5	0986-00804-0800
93422	4	B5, B6, C5, C6	0986 C0803-101C
EPROM	1	A1 (VG A)	ROM/EPROM OPTIONS KIT 0639-00803-0009
EPROM	1	B1 (VG B)	
EPROM	1	C1 (VG C)	
EPROM	1	D1 (VG D)	
JUMPER WIRE	8	JW1-8	0986-00805-0200
BUSS BAR	2	BB1, 2	0986-00804-0900
P.C. BOARD	1		A080-91399-E000
24 PIN RIGHT ANGLE CONN.	3	J 3,4,5	0986-00804-4700
28 PIN SOCKET	4	ICS A1, B1, C1, D1	0986-00804-0300
22 PIN SOCKET	8	ICS B5,6, C5,6, J5, K5, L5, M5	0986-00804-0700
18 PIN SOCKET	2	ICS K6 L6	0986-00804-0600
PC BD SPACER	4	PCMH1-PCMH4	0986-00701-00XF
PC MTG SCREW	4	PCMH5-PCMH8	0017-00101-0339

REVISIONS

PROJECT ENG: A. GOSH			USED ON KOZMIK KROOZ'R	Bally / MIDWAY MFG. CO. FRANKLIN PK ILL
DO NOT SCALE DWG	HEAT TREAT	SCALE FULL	NO. REQ'D ONE PER	
DIM TOLERANCES UNLESS SPECIFIED	DRN.	MAT'L.	VIDEO GENERATOR P.C. ASSY DWG A082-91399-H000	PART NO M051-00639-A034
	CKD.	FINISH		
	DATE 02/18/83			

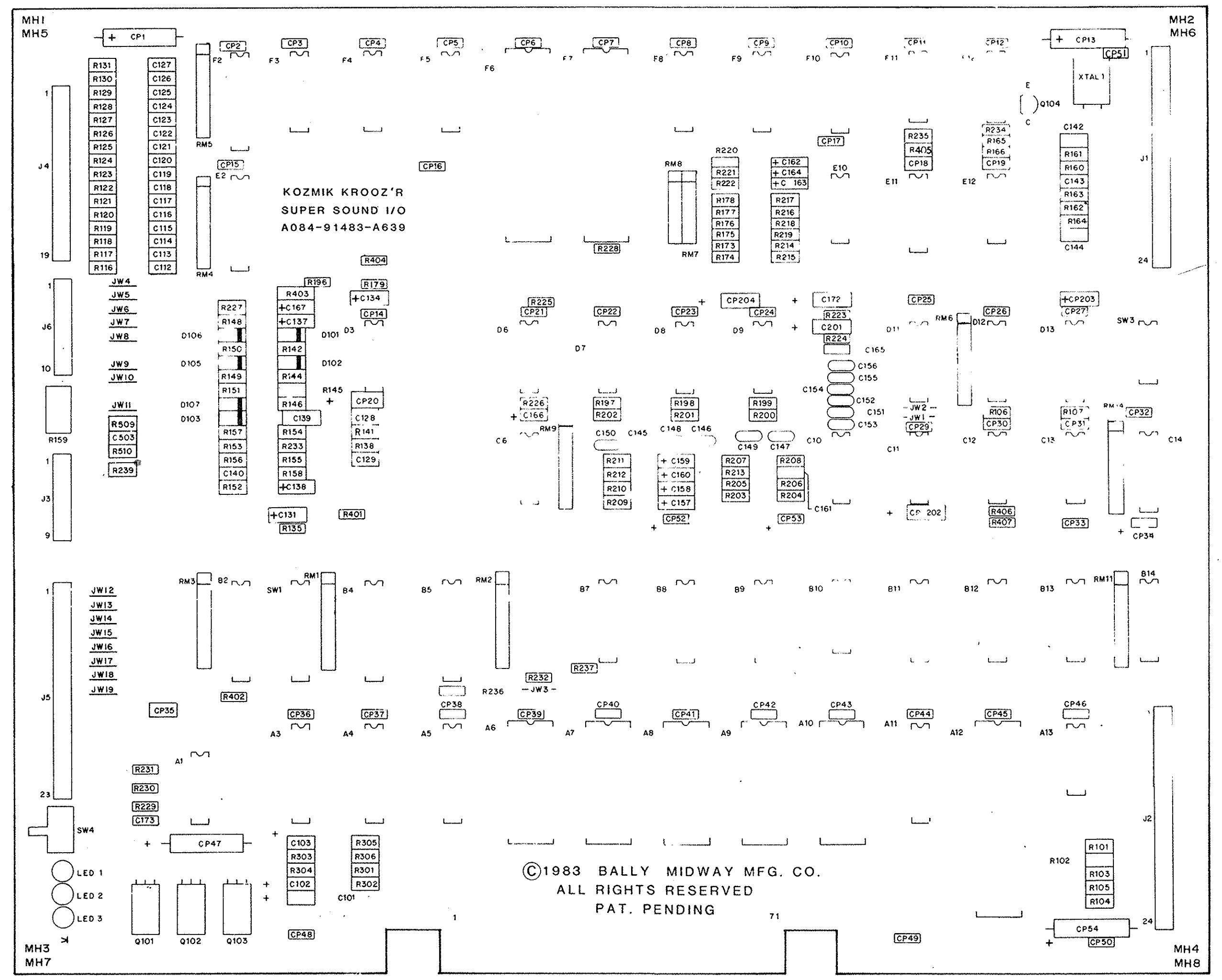


PROJECT ENG A. GHOSH		USED ON KOZMIK KROOZ'R	Bally / MIDWAY MFG. CO.
	SCALE FULL	NO REQ'D 1 PER	
DATE 03/1/83	SCHEMATIC VIDEO GEN. A084-91399-H941		PART NO M051-00986 -H005

NOTE ALL P = +5V

DESIGNATION LIST

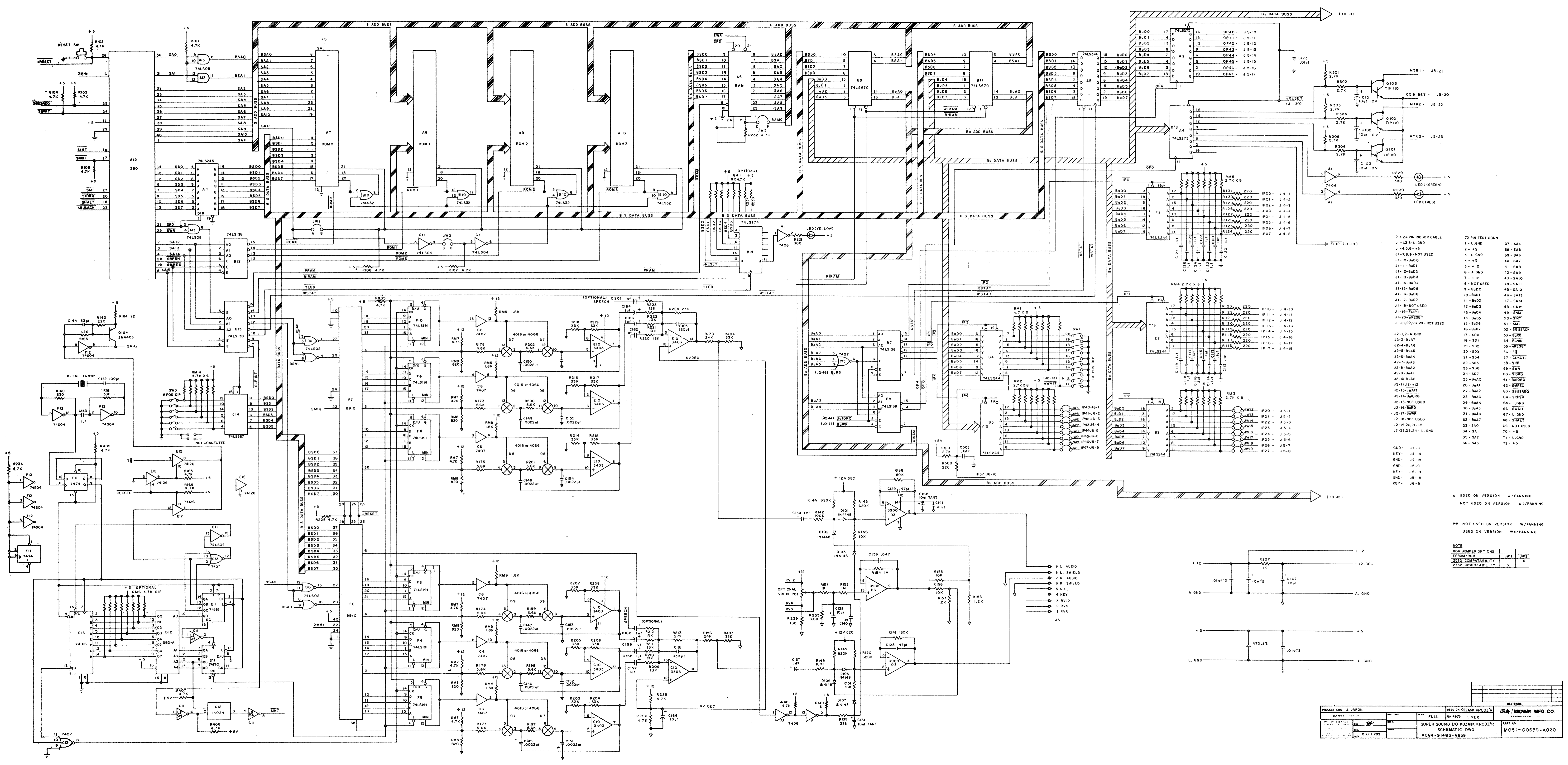
DESIGNATION	DESCRIPTION
C101-C103	10MF 25V AX.TANT.
C112-C127	.1MF 50V AX.CER.
C128-C129	47PF 50V AX. CER.
C131	10 MF 25V AX. TANT.
C134	1MF 20V AX. TANT.
C137	1MF " " "
C138	10MF 25V AX. TANT.
C139	.047 MF 100V MYLAR
C140	.01MF 50V AX. CER.
C142	100PF 50V AX. CER.
C143	.1MF 50V AX. CER.
C144	33PF 50V AX. CER
C145-C156	.0022MF 100V 10% MYLAR
C157-C159	1MF 20V AX. TANT
C161	330 PF 50V AX. CER
C162-C164	1MF 20V AX. TANT
C165	330PF 50V AX. CER
C166, C167	10MF 25V AX. TANT.
C172	10MF 25V AX. TANT.
C173	.01MF 50V AX. CER
C503	.1MF 50V AX. CER.
CP1	470MF 16V AX. ELECT.
CP2-CP12	.01MF 50V AX CER.
CP13	470MF 16V AX. ELECT.
CP14-CP19	.01MF 50V AX. CER.
CP20	10MF 25V AX. TANT.
CP21-CP27	.01MF 50V AX. CER.
CP29-CP33	.01MF 50V AX. CER.
CP34	10MF 25V AX TANT
CP35-CP46	.01MF 50V AX. CER.
CP47	470MF 16V AX. ELECT.
CP48-CP51	.01MF 50V AX. CER
CP52, CP53	10MF 25V AX. TANT.
CP54	470MF 16V AX. ELECT.
CP202-CP204	10MF 25V AX. TANT.
R101-R107	4.7K OHM 1/4W 5% CARBON
R116-R131	220 " " " "
R135	33K " " " "
R138	180K " " " "
R141	180K " " " "
R142	100K " " " "
R144, R145	620K " " " "
R146	10K " " " "
R148	100K " " " "
R149, R150	620K " " " "
R151	10K " " " "
R152	1MEG. " " " "
R153	1K " " " "
R154	1MEG " " " "
R155, R156	10K " " " "
R157, R158	1.2K " " " "
R160, R161	330 " " " "
R162	220 " " " "
R163	1.2K " " " "
R164	22 " " " "
R165, R166	4.7K " " " "
R173-R178	5.6K " " " "
R179	24K " " " "
R196	24K " " " "
R197-R202	5.6K OHM 1/4W 5% CARBON
R203-R208	33K " " " "
R209-R211	13K " " " "
R213	27K " " " "
R214-R219	33K " " " "
R220-R222	13K " " " "
R224	27K " " " "
R225, R226	4.7K " " " "
R227	1K " " " "
R228	4.7K " " " "
R231	300 " " " "
R232	4.7K " " " "
R233	3K " " " "
R234, R235	4.7K " " " "
R239	100 " " " "
R301-R306	2.7K " " " "
R401	1K " " " "
R402	4.7K " " " "
R403-R404	33K " " " "
R405-R407	4.7K " " " "
R509	220 " " " "
R510	2.7K " " " "
RM1	4.7K OHM 10 PIN S.I.P.
RM2-RM5	2.7K " 10 PIN S.I.P.
RM7	4.7K " 8 PIN S.I.P.
RM8	820 " 8 PIN S.I.P.
RM9	1.8K " 10 PIN S.I.P.
RM14	4.7K " 10 PIN S.I.P.
D101-D103	1N4148
D105-D107	1N4148
Q101-Q103	TIP110
Q104	2N4403
ICA1	7406
" A3, A4	74LS273
" A5	74LS374
" A6	1K X 8 RAM
" A7	ROM/EPROM 0
" A8	" " 1
" A9	" " 2
" A10	" " 3
" A11	74LS245
" A12	Z-80 CPU
" A13	74LS08
" B2, B4, B5	74LS244
" B7, B8	74LS138
" B9	74LS670
" B10	74LS32
" B11	74LS670
" B12, B13	74LS138
" B14	74LS174
" C6	7407
" C10	MC3403
" C11	74LS04
" C12	MC14024
IC C13	7427
" C14	74LS367
" D3	LM3900
" D6	74LS02
" D7-D9	MC14016
" D11	74190
" D12	PROMSB2A
" D13	74166
" E2	74LS244
" E10	MC3403
" E11	74161
" E12	74126
" F2	74LS244
" F3-F5	74LS191
" F6, F7	AY-3-8910
" F8-F10	74LS191
" F11	7474
" F12	74S04
ICSA6-ICSA10	24 PIN IC SOCKET
" A12	40 PIN " "
" D12	16 PIN " "
" F6, F7	40 PIN " "
J1, J2	24 PIN KK100 RT. ANGLE CONN.
J3	9 PIN KK100 RT ANGLE W/ 4 OMIT
J4	19 PIN KK100 RT.ANGLE W/14 OMIT
J5	23 PIN KK100 RT.ANGLE W/19 OMIT
J6	10 PIN KK100 RT.ANGLE W/8 OMIT
JW1, JW2, JW4-JW19	JUMPER WIRE
LED 3	YELLOW LED
SW1	10 POSITION DIP
SW3	8 " "
SW4	PUSH BUTTON S.W.
XTAL 1	16 MHZ CRYSTAL
MHQ101-MHQ103	SNAP
MH1 - MH4	SPACER
MH5 - MH8	6-32 X 6 M.S.
A080-91483-A639	SUPER SOUND I/O BOARD



CROSS REFERENCE LIST

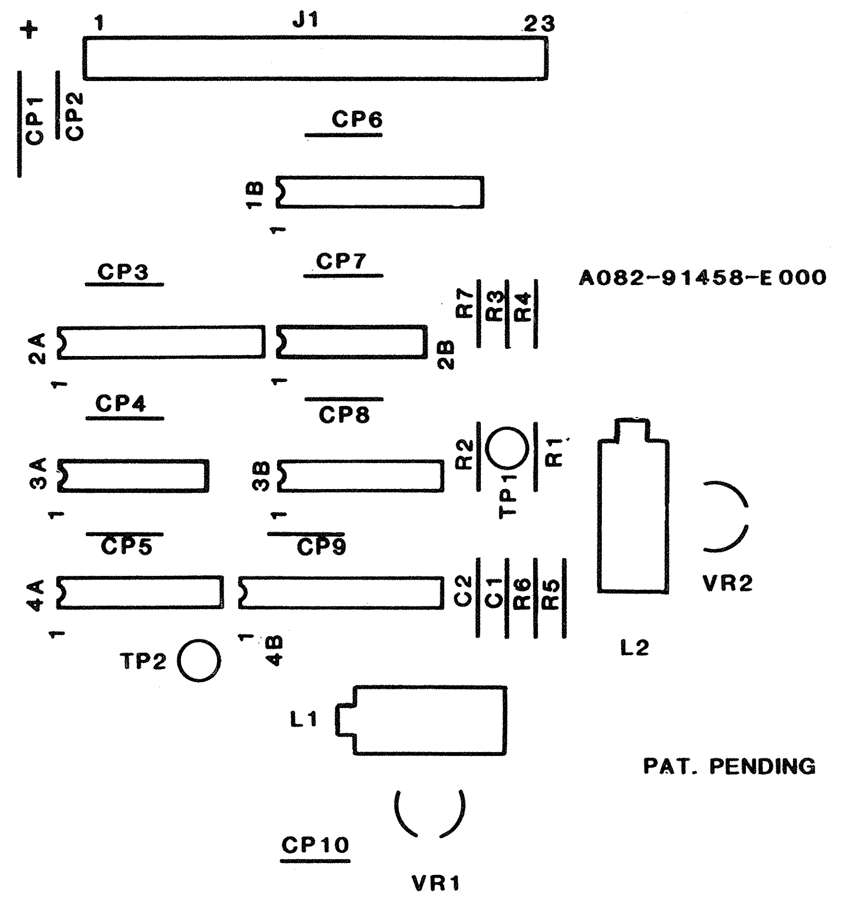
DESCRIPTION	QTY	DESIGNATION	PART NOS.
33PF 50V 5% AX.CER	1	C144	0986-00800-0900
47 PF 50V AX.CER.	2	C128, C129	0986-00800-2800
100PF 50V 5% AX.CER.	1	C142	0986-00800-1000
330PF 50V AX. CER.	2	C161, C165	0986-00800-1300
.0022MF 100V 10% MYLAR	12	C145-C156	0986-00800-1200
.047MF 100V MYLAR	1	C139	0986-00800-2600
.01MF 50V AX. CER.	47	CP2-CP12, CP14-CP19, CP21-CP27, CP29-CP33, CP35-CP46, CP48-CP51, C140, C173	0986-00800-2000
.1MF 50V AX. CER.	18	C112-C127, C143, C503	0986-00800-1100
1MF 20V AX. TANT.	8	C134, C137, C157-C159, C162-C164	0986-00800-1400
10MF 25V AX. TANT.	15	CP34, CP52-CP53, CP202-CP204, CP20, C101-C103, C131, C138, C166, C167, C172	0986-00800-0700
470 MF 16V AX. ELECT.	4	CP1, CP13, CP47, CP54	0986-00800-2700
22 OHM 1/4W 5% CARBON	1	R164	0062-063B3-1XXX
100 " " " "	1	R239	0062-110B3-1XXX
220 " " " "	18	R116-R131, R162, R509	0062-133B3-1XXX
300 " " " "	1	R231	0062-141B3-1XXX
330 " " " "	2	R160-R161	0062-144B3-1XXX
1K " " " "	3	R153, R227, R401	0062-179B3-1XXX
1.2K " " " "	3	R157, R158, R163	0062-183B3-1XXX
2.7K " " " "	7	R301-R306, R510	0062-199B3-1XXX
3K " " " "	1	R233	0062-201B3-1XXX
4.7K " " " "	19	R101-R107, R165, R166, R225, R226, R228, R232, R234, R235, R402, R405-R407	0062-211B3-1XXX
5.6K " " " "	12	R173-R178, R197-R202	0062-215B3-1XXX
10K " " " "	4	R146, R151, R155, R156	0062-227B3-1XXX
13K " " " "	6	R209-R211, R220-R222	0062-233B3-1XXX
24K " " " "	2	R179, R196	0062-245B3-1XXX
27K " " " "	2	R213, R224	0062-247B3-1XXX
33K " " " "	15	R135, R203-R208, R214-R219, R403-R404	0062-251B3-1XXX
100K " " " "	2	R142, R148	0062-275B3-1XXX
180K " " " "	2	R138, R141	0062-287B3-1XXX
620K " " " "	4	R144, R145, R149, R150	0062-313B3-1XXX
1MEG. " " " "	2	R152, R154	0062-323B3-1XXX
820 OHM 8PIN S.I.P.	1	RM8	0986-00805-0800
1.8K " 10PIN S.I.P	1	RM9	0986-00805 0600
2.7K " 10PIN S.I.P.	4	RM2 - RM5	0986-00805-0500
4.7K " 8 PIN S.I.P.	1	RM7	0986-00805-0400
4.7K " 10PIN S.I.P.	2	RM1, RM14	0986-00805-0300
1N4148	6	D101-D103, D105-D107	0986-00801-0200
2N4403	1	Q104	0986-00802-0500
TIP 110	3	Q101-Q103	0986-00802-0400
74LS02	1	D6	0986-00803-7400
74LS04	1	C11	0986-00803-6900
74S04	1	F12	0986-00803-6600
7406	1	A1	0986-00803-7600
7407	1	C6	0986-00803-5900
74LS08	1	IC A13	0986-00803-7300
7427	1	" C13	0986-00803-7200
74LS32	1	" B10	0986-00803-6100
7474	1	" F11	0986-00803-6700
74126	1	" E12	0986-00803-6800
74LS138	4	" B7, B8, B12, B13	0986-00803-6500
74161	1	" E11	0986-00803-5100
74166	1	" D13	0986-00803-5300
74LS174	1	" B14	0986-00803-7500
74190	1	" D11	0986-00803-9400
74LS191	6	" F3-F5, F8-F10	0986-00803-5600
74LS244	5	" B2, B4, B5, E2, F2	0986-00803-4800
74LS245	1	" A11	0986-00803-6400
74LS273	2	" A3, A4	0986-00803-4700
74LS367	1	" C14	0986-00803-7000
74LS374	1	" A5	0986-00803-4600
74LS670	2	" B9, B11	0986-00803-6300
AY-3-8910	2	" F6, F7	0986-00803-8500
LM3900	1	" D3	0986-00803-4900
MC3403	2	" C10, E10	0986-00803-5000
MC14016	3	" D7-D9	0986-00803-6200
MC14024	1	" C12	0986-00803-7100
PROM SB2-A	1	" D12	0986-00803-8200
RAM 1K X 8	1	" A6	0986-00803-8000
ROM/EPROM 0	1	" A7 (EPROM/ROM OPTIONS KIT)	0639-00803-0008
" " 1	1	" A8 (EPROM/ROM OPTIONS KIT)	
" " 2	1	" A9 (EPROM/ROM OPTIONS KIT)	
" " 3	1	" A10 (EPROM/ROM OPTIONS KIT)	
Z-80 (3880)	1	" A12	0986-00803-5500
16 PIN IC SOCKET	1	ICSD12	0986-00804-1400
24 PIN " "	5	ICSA6 - ICSA10	0986-00804-1600
40 PIN " "	3	ICSA12, ICSF6, ICSF7	0986-00804-1500
9 PIN KK100 RT.ANGLE W/4 OMIT	1	J3	3000-16366-0901
10 PIN KK100 RT.ANGLE W/8 OMIT	1	J6	3000-16366-1001
19 PIN KK100 RT.ANGLE W/14 OMIT	1	J4	3000-16366-1901
23 PIN KK100 RT.ANGLE W/19 OMIT	1	J5	3000-16366-2301
24 PIN KK100 RT.ANGLE	2	J1, J2	0986-00804-4700
JUMPER WIRE	18	JW1, JW2, JW4 - JW19	0986-00804-4000
YELLOW LED	1	LED 3	0986-00804-2000
8 POSITION DIP SW.	1	SW3	0986-00805-0900
10 POSITION DIP SW.	1	SW1	0986-00805-1000
PB SWITCH	1	SW4	0986-00804-1700
16 MHZ CRYSTAL W/3RD LEAD	1	XTAL 1	0986-00805-1100
SNAPS	3	MHQ101 - MHQ103	0017-00007-0134
SPACER	4	MH1 - MH4	0986-00702-00XF
6-32 X 6 M.S.	4	MH5 - MH8	0017-00101-0153
SUPER SOUND I/O BOARD	1	———	A080-91483-A639

PROJECT ENG: C. MEDNICK	USED ON KOZMIK KROOZ'R	Bally / MIDWAY MFG. CO. FRANKLIN PK. ILL.	REVISIONS
HEAT TREAT	SCALE FULL	NO REQ'D 1 PER	
DRN. TBB	MAT'L	ASSEMBLY DRAWING SUPER SOUND I/O P.C. BOARD A084-91483-A639	PART NO M051 - 00639 - A035
CKD.	FINISH		
DATE 02/21/83			


REVISIONS
PROJECT ENG J. JARON
USED ON KOZMIK KROOZ'R
Bally / MIDWAY MFG. CO.
FRANKLIN PK ILL
SCALE FULL
NO REQ'D 1 PER
DATE 03/1/83
SUPER SOUND I/O KOZMIK KROOZ'R
SCHEMATIC DWG
A084-91483-A639
PART NO
M051-00639-A020

DESIGNATION LIST

DESIGNATION NO.	DESCRIPTION
C1, C2	100 pf AX. CER 50 V
CP1	10 µf AX. ELECT. 16 V
CP2 - CP10	.01 µf AX. CER. 50 V
R1	43 ohm 1/4 W 5%
R2	1.3 K " " 2%
R3, R4	2.7 K " " 5%
R5	43 " " 5%
R6	1.3 K " " 2%
R7	2.7 K " " 5%
VR1, VR2	100 ohm POT 1/8 W
IC 2A	74 LS 244
" 3A	74393
" 4A	4040 B
" 1B	74 LS 244
" 2B	74393
" 3B	4040 B
" 4B	74 SC240
L1, L2	10 - 40 µH COIL
J1	23 PIN KK-100 RT. ANGLE PIN 18 OMITTED
A080-91458-E000	ANALOG JOYSTIC P.C.



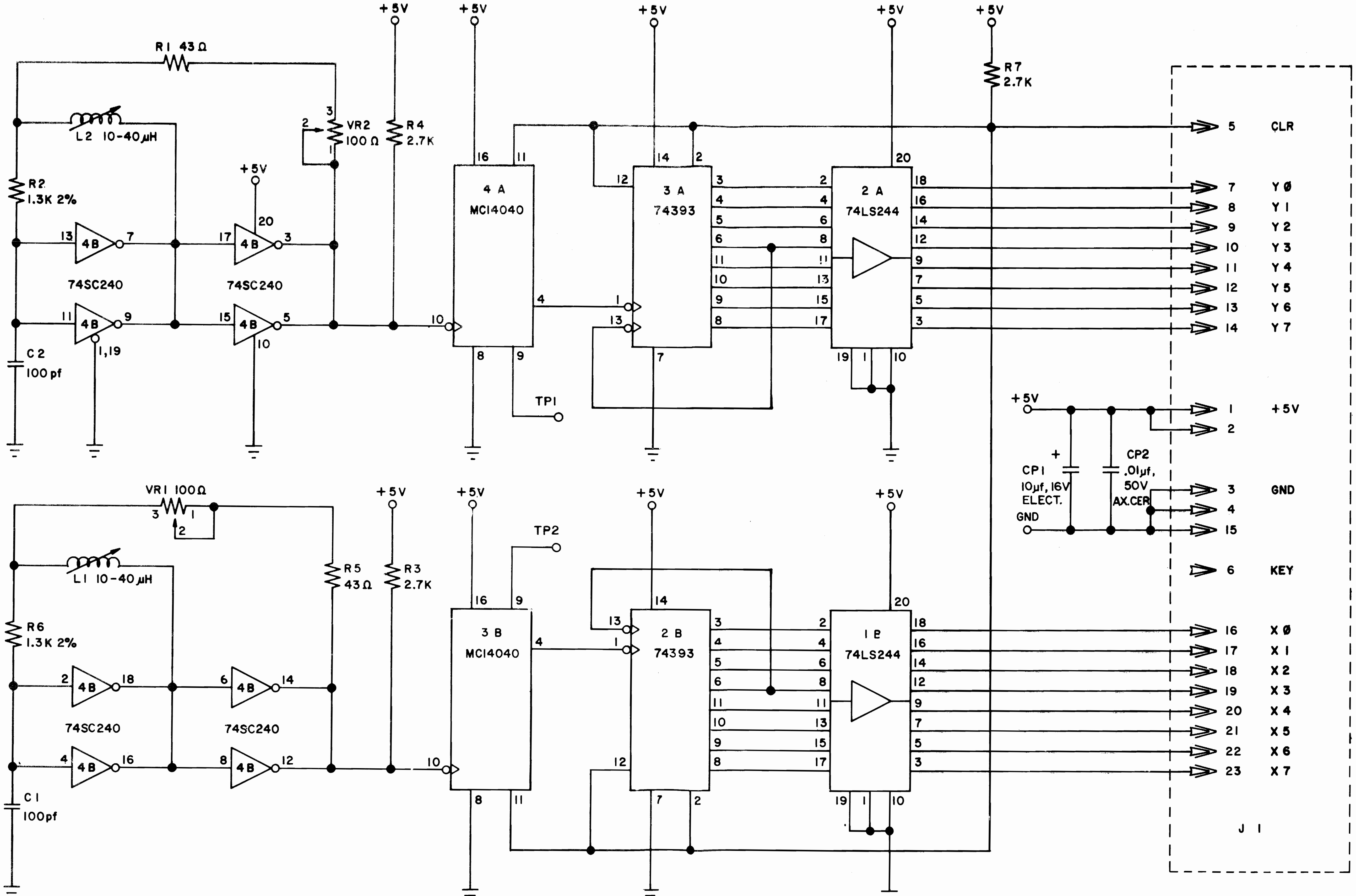
ANALOG JOYSTIC P.C.

CROSS REFERENCE LIST

DESCRIPTION	QTY	DESIG. NO.	PART NO.
100 pf AX. CER. 50 V	2	C1, C2	0639-00800-0003
.01 µf AX. CER. 50 V	9	CP2 - CP10	0628-00800-0100
10 µf AX. ELECT. 16 V	1	CP1	0628-00800-0300
43 ohm 1/4 W 5%	2	R1, R5	0062-083B3-1XXX
1.3 K " " 2%	2	R2, R6	0062-185B2-1XXX
2.7 K " " 5%	3	R3, R4, R7	0062-199B3-1XXX
100 " POT 1/8 W	2	VR1, VR2	0639-00804-0004
74 LS 244	2	IC 1B, 2A	0639-00803-0003
74393	2	" 2B, 3A	0639-00803-0005
4040 B	2	" 3B, 4A	0639-00803-0004
74 SC 240	1	" 4B	0639-00803-0006
10 - 40 µH COIL	2	L1, L2	0639-00804-0003
23 PIN KK-100 RT. ANGLE PIN 18 OMITTED	1	J1	3000-16366-2302
ANALOG JOYSTIC P.C.	1	———	A080-91458-E000

REVISIONS

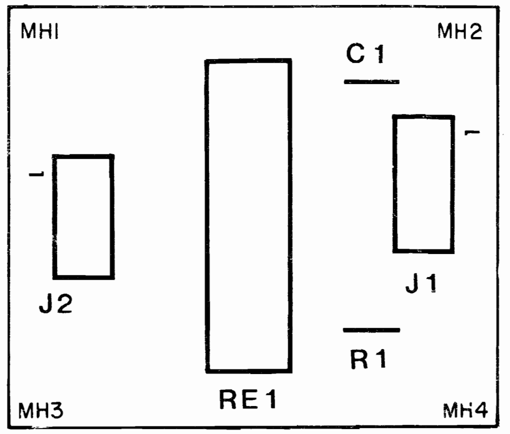
PROJECT ENG: J. BOYDSTON		USED ON KOZMIK KROOZ'R	Bally / MIDWAY MFG. CO. FRANKLIN PK. ILL.
DO NOT SCALE DWG.	HEAT TREAT / SCALE: FULL	NO. REQ'D 1 PER	
DIM. TOLERANCES UNLESS SPECIFIED: CONCENTRICITY T.I.R. .003; FRACTIONAL ± 1/64; DECIMAL ± .005; HOLE DIA. + .002 - .000	DRN. TSB / CKD. JBB / DATE 03/02/83	MAT'L. / FINISH	ASSY. DWG., ANALOG JOYSTIC P.C. A082-91458-E000 A084-91458-E000
			PART NO. M051 - 00986 - E023



PROJECT ENG: JOHN BOYDSTON			USED ON KOZMIK KROOZ'R	Bally / MIDWAY MFG. CO. FRANKLIN PK. ILL.
DO NOT SCALE DWG.	HEAT TREAT	SCALE FULL	NO. REQ'D 1 PER	
DIM. TOLERANCES UNLESS SPECIFIED — CONCENTRICITY T.I.R. .003; FRACTIONAL ± 1/64; DECIMAL ± .005; HOLE DIA. + .002 − .000	DRN. C.C. / CKD. JBB / DATE 2/17/83	MAT'L. / FINISH	SCHEMATIC DWG, ANALOG JOYSTIC P.C. A082-91458-E000 A084-91458-E000	PART NO. M051-00986 -E024

DESIGNATION LIST

DESIGNATION NO.	DESCRIPTION
C1	.01 µf AX.CER.50V
R1	1.5 K ohm 1/4 W 5%
RE1	SOLID STATE RELAY
J1	4 PIN KK-156 STR. CONN. PIN 3 OMITTED
J2	CABLE CONNECTION
PCMH1-PCMH4	P.C. MTG HDRW
A080-90509-C000	P.C. BOARD

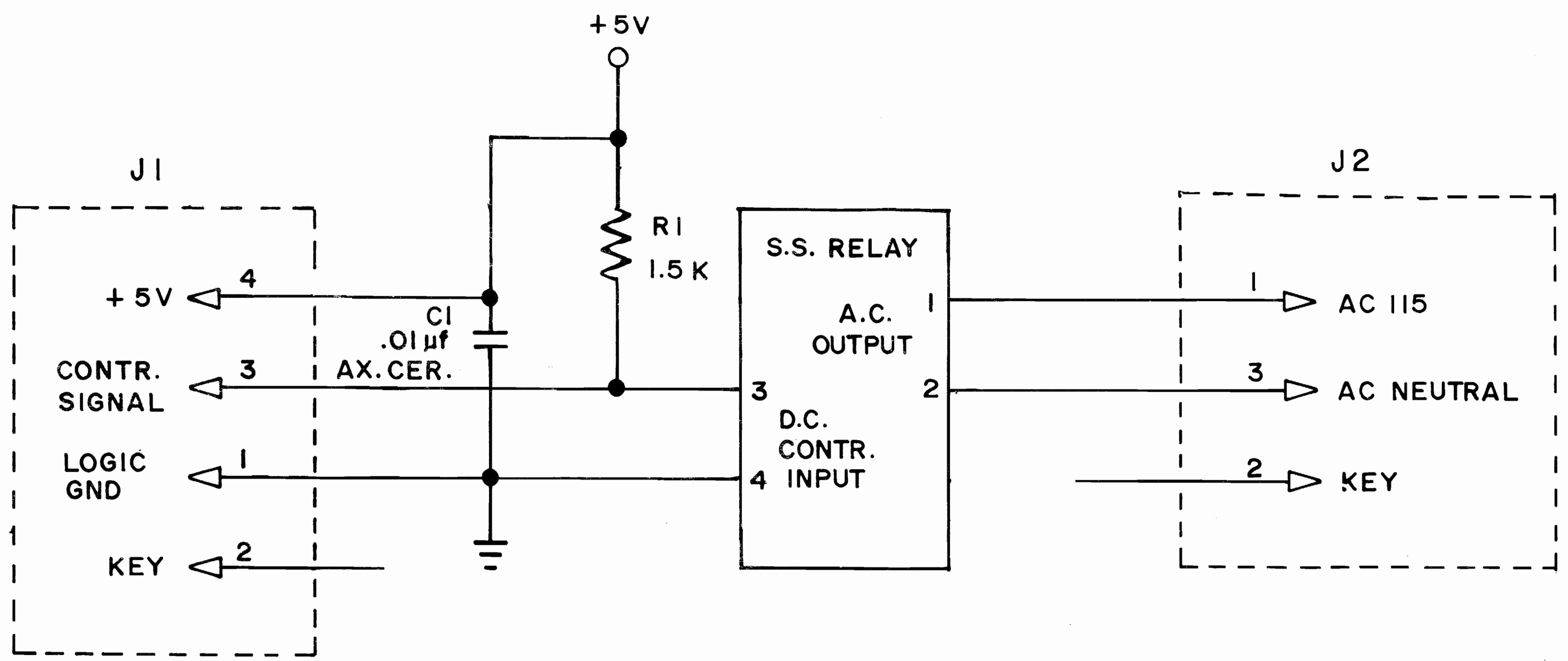


CROSS REFERENCE LIST

DESCRIPTION	QTY	DESIGNATION NO.	PART NO.
.01 µf AX CER 50 V	1	C1	0628-00800-0100
1.5 K ohm 1/4 W 5%	1	R1	0062-187B3-!XXX
SOLID STATE RELAY	1	RE1	0639-00804-0002
4 PIN KK-156 STR.CONN. PIN 3 OMITTED	1	J1	3000-16367-0410
CABLE CONNECTION	1	J2	A639-00024-0000
P.C. MTG HDRW	4	PCMH1-PCMH4	0017-00042-0320
P.C. BOARD	1	———	A080-90509-C000

REVISIONS

PROJECT ENG: J. BOYDSTON		USED ON KOZMIK KROOZ' R	Bally / MIDWAY MFG. CO. FRANKLIN PK ILL
DO NOT SCALE DWG.	HEAT TREAT	SCALE FULL	NO. REQ'D 1 PER
DIM. TOLERANCES UNLESS SPECIFIED CONCENTRICITY T.I.R. .00? FRACTIONAL 1/6? DECIMAL .005 HOLE DIA + .002 .000	DRN. TBB CKD. DATE 02/28/83	MAT'L. FINISH	ASSEMBLY DWG SOLID STATE RELAY P.C. A082-90509-C000 A084-90509-C000
			PART NO. M051- 00114 -C019

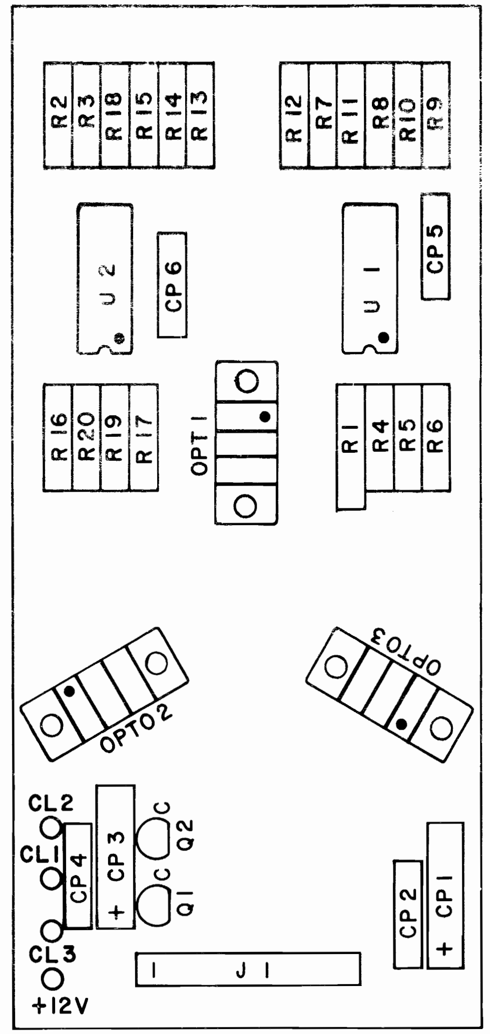


REVISIONS

PROJECT ENG: J. BOYDSTON	USED ON KOZMIK KROOZ'R	Bally / MIDWAY MFG. CO. FRANKLIN PK. ILL
DO NOT SCALE DWG.	HEAT TREAT	SCALE FULL
NO. REQ'D 1 PER		
DIM. TOLERANCES UNLESS SPECIFIED CONCENTRICITY T.I.R. .003 FRACTIONAL ± 1/64 DECIMAL ± .005 HOLE DIA +.002 .000	DRN. BK CKD. DATE 02/28/83	MAT'L. FINISH
SCHEMATIC DWG S.S. RELAY P.C. A082-90509-C000 A084-90509-C000	PART NO. M051-00114-C018	

DESIGNATION LIST

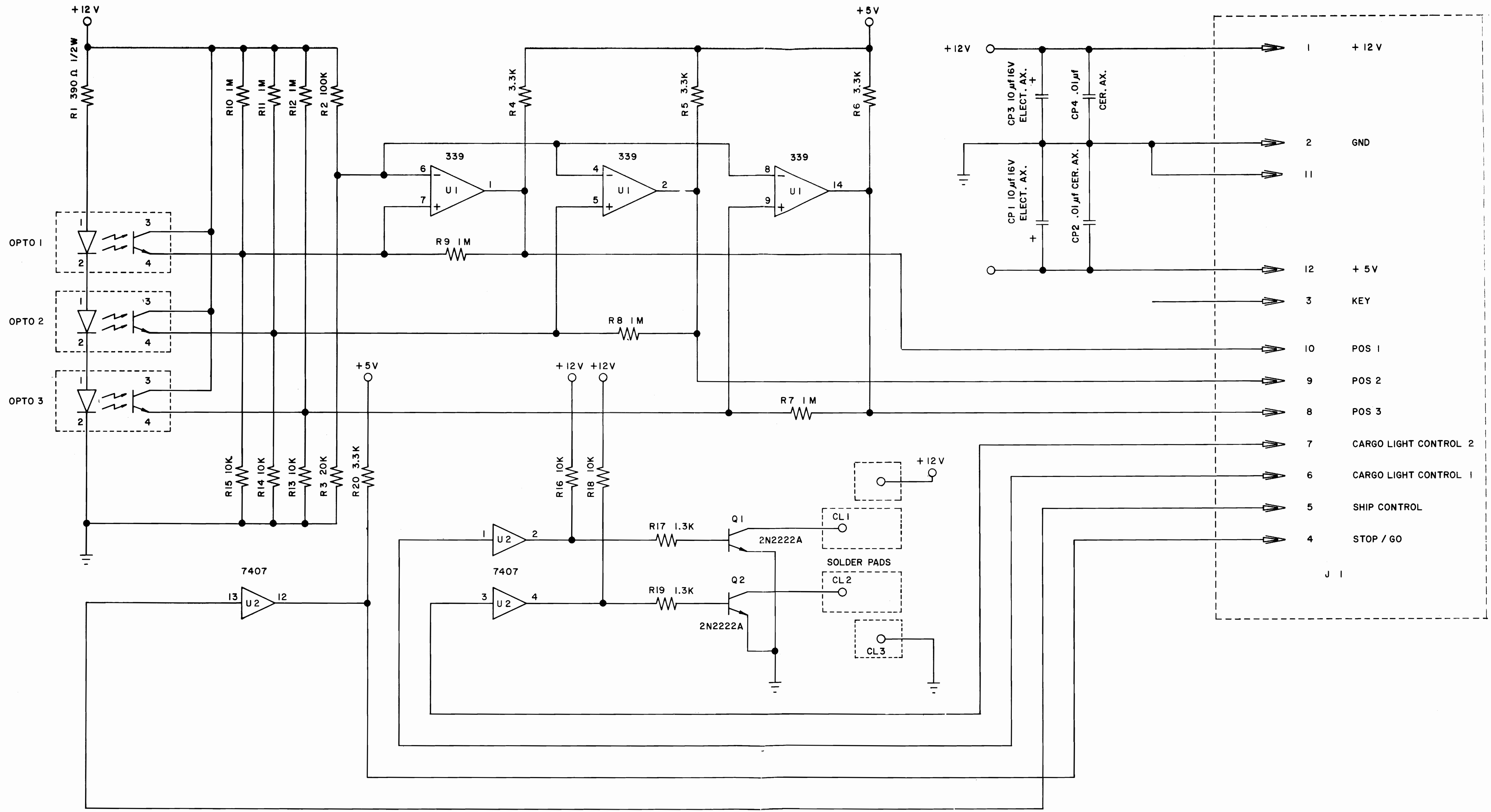
DESIGNATION NO.	DESCRIPTION
CP 1	10 µf 16V AX. ELECT.
CP 2	.01 µf 50V AX. CER.
CP 3	10 µf 16V AX. ELECT.
CP 4-6	.01 µf 50V AX. CER.
R 1	390 Ω 1/2W 5% CRBN FILM
R 2	100K 1/4W " "
R 3	20K " " "
R 4-6	3.3K " " "
R 7-12	1 M " " "
R 13-16	10K " " "
R 17	1.3K " " "
R 18	10K " " "
R 19	1.3K " " "
R 20	3.3K " " "
Q 1,2	2N2222A TRANSISTOR
U 1	LM339
U 2	7407
OPTO1-3	OPTICAL SENSOR
J 1	KK-100 VERT 12 PIN
———	PLASTIC RIVET
A080-91434-D639	P.C. BOARD



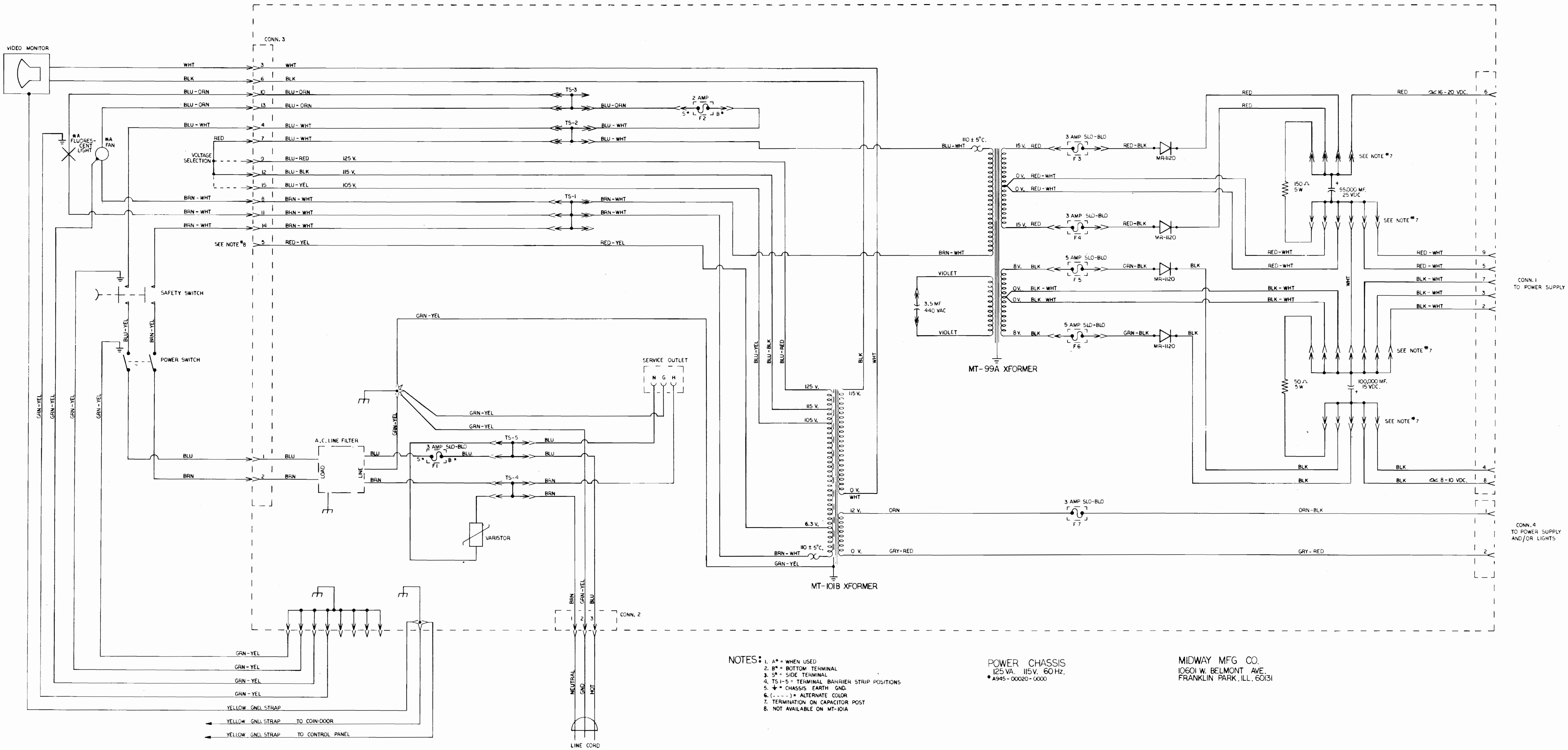
CROSS REFERENCE LIST

DESCRIPTION	Q'ty	DESIGNATION NO.	PART NO.
.01 µf 50V AX. CER.	4	CP2,4-6.	0639-00800-0002
10 µf 16V AX. ELECT.	2	CP1,3.	0639-00800-0001
390 Ω 1/2W 5% CRBN FILM	1	R 1	0062-150D3-1XXX
1.3K 1/4W " "	2	R 17,19.	0062-185B3-1XXX
3.3K " " "	4	R 4-6,20.	0062-203B3-1XXX
10K " " "	5	R 13-16,18.	0062-227B3-1XXX
20K " " "	1	R 3	0062-241B3-1XXX
100K " " "	1	R 2	0062-275B3-1XXX
1 M " " "	6	R 7-12.	0062-323B3-1XXX
2N2222A TRANSISTOR	2	Q 1,2.	0639-00802-0001
LM339	1	U 1	0639-00803-0002
7407	1	U 2	0639-00803-0001
OPTICAL SENSOR	3	OPTO 1-3.	0639-00804-0001
KK-100 VERT 12 PIN	1	J 1	3000-16364-1201
PLASTIC RIVET RND.HD	6	———	0017-00072-0091
P C BOARD	1	———	A080-91434-D639

PROJECT ENG: JOHN BOYDSTON		USED ON KOZMIK KROOZ'R	Bally / MIDWAY MFG. CO. FRANKLIN PK. ILL.
DO NOT SCALE DWG.	HEAT TREAT	SCALE FULL	NO. REQ'D 1 PER
DIM. TOLERANCES UNLESS SPECIFIED — CONCENTRICITY T.I.R. .001; FRACTIONAL ±1/64; DECIMAL ±.005; HOLE DIA. +.002 .000	DRN. C.L.	MAT'L.	ASSY DRAWING SENSOR P.C. A084-91434-D639
	CKD. JBB	FINISH	PART NO. M051-00639-D006
	DATE 03/02/83		



PROJECT ENG: JOHN BOYDSTON		USED ON MOTHER SHIP	Bally / MIDWAY MFG. CO. FRANKLIN PK. ILL.
DO NOT SCALE DWG.	HEAT TREAT / SCALE	NO. REQ'D 1 PER	
DIM. TOLERANCES UNLESS SPECIFIED: CONCENTRICITY T.I.R. .003, FRACTIONAL ±1/64, DECIMAL ±.005, HOLE DIA. +.002 −.000	DRN. C.L. / CKD. JBB / DATE 02/28/83	SCHEMATIC DRAWING SENSOR P.C. A084-91434-D639	PART NO. M051-00639-D007



NOTES:
1. A* = WHEN USED
2. B* = BOTTOM TERMINAL
3. S* = SIDE TERMINAL
4. TS 1-5 = TERMINAL BARRIER STRIP POSITIONS
5. ⏚ = CHASSIS EARTH GND.
6. (- - - -) = ALTERNATE COLOR
7. TERMINATION ON CAPACITOR POST
8. NOT AVAILABLE ON MT-101A

POWER CHASSIS
125 VA. 115 V. 60 Hz.
* A945-00020-0000

MIDWAY MFG CO.
10601 W. BELMONT AVE.
FRANKLIN PARK, ILL. 60131